

Advant[®] OCS
with Master software

PROFIBUS-DP
Advant[®] Controller 110/160

User's Guide

3BDS 100 313R301



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WARNING	Hazards which could result in personal injury
CAUTION	Hazards which could result in equipment or property damage
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Chapter 1 Introduction

1.1 Before You Begin

This manual describes the usage of PROFIBUS-DP (DPV1) interface implemented in Advant Controller 110 and Advant Controller 160.

1.2 Equipment Requirements

Advant Controller 110

To use the PROFIBUS-DP interface in Advant Controller 110, you must have the following software and hardware:

1. Advant Controller 110 Basic Unit with Processor Module PM634,
2. Advant Controller 110 BASE SW*2.2 or later,
3. Advant Engineering AMPL Control Configuration 1.6 or later.

Advant Controller 160

To use the PROFIBUS-DP interface in Advant Controller 160, you must have the following software and hardware:

4. Advant Controller 160 Basic Unit with Processor Module PM644,
5. Advant Controller 160 BASE SW*2.0 or later
6. Advant Engineering AMPL Control Configuration 1.7 or later.

1.3 How to Use This Book

This book is organized into chapters and sections as shown in [Figure 1-1](#).

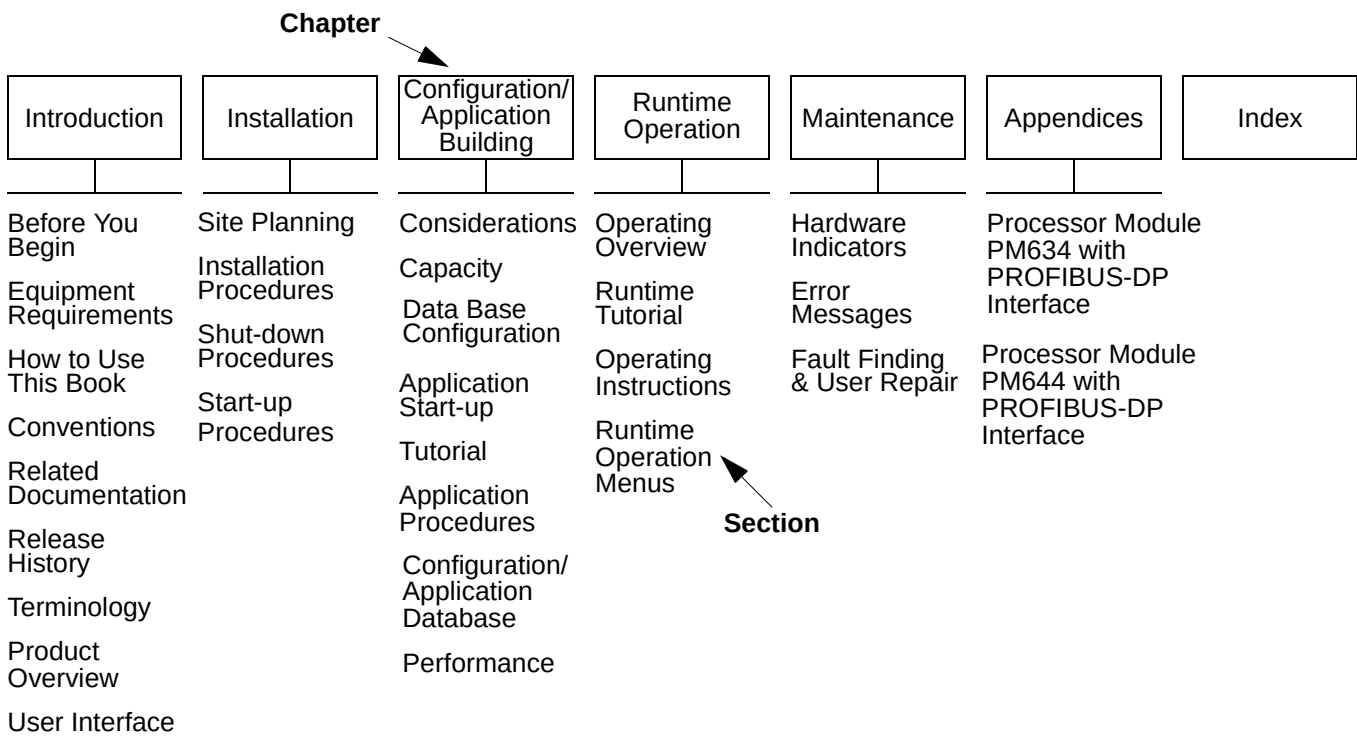


Figure 1-1. Organization of Manual

1.4 Conventions

1.4.1 General

Books, manuals, and so on, referenced in the text are written in *italic*.

Terms defined in [Section 1.7, Terminology](#) are in *italic*.

Filenames, directory names, acronyms appear in all capitals.

Words, which you have to type exactly in that form, are shown in **boldface** type, and if possible in CAPITAL letters, for example, **POWERSTN**.

Texts and system messages displayed on the screen are shown in **Courier** font, for example, **Select Options**.

Application windows, document windows, and dialog boxes are referenced by their names in **boldface** type, for example, **PC Section** window.

1.4.2 Keys

Special keyboard keys are written plain with small capitals:

- ALT, CTRL, DEL, ENTER, ESC, INS, KEYPAD 5, NUMLOCK, SCROLL LOCK, SHIFT, SPACEBAR
- BACKSPACE (for <-)
- DOWN (for down arrow, numeric keypad 2), LEFT (for left arrow, numeric keypad 4), UP (for up arrow, numeric keypad 8), RIGHT (for right arrow, numeric keypad 6)
- F1, F2, and so on (for function keys)
- MINUS (for '-' sign in numeric keypad), PLUS (for '+' sign in numeric keypad), ASTERISK (for '*' sign in numeric keypad)
- PGDOWN (for page down, numeric keypad 9), PGUP (for page up, numeric keypad 3)
- 1, 2, ... (for keys in the upper row of the traditional typewriter keyboard, not in the numeric keypad)

Shorthand for combined key usage, such as holding down the CTRL key and then pressing the key L:

CTRL+L.

1.4.3 Commands and Menus

Commands are written bold with capital initial:
choose **Exit** ...

Menus are written bold with capital initial:
in the **File** menu ...

Shorthand for commands that you choose as items from menus, for example, command **Exit** from the **File** menu, appears as **File | Exit**.

1.5 Related Documentation

The following table contains documentation related to PROFIBUS-DP in Advant Controller:

Table 1-1. Related Documentation

Category	Title	Description
General	Advant Controller 110 2.2 User's Guide, 3BSE 009 131R0101	Description of Advant Controller 110
	Advant Controller 160 2.0 User's Guide, 3BDS 005 555R101	Description of Advant Controller 160
	ABB Master Installation Rules	Guidelines on earth connection, power supply, etc.

Table 1-1. Related Documentation

Category	Title	Description
General	AMPL Configuration Advant Controller 100 Series Reference Manual 3BSE 009 626R401	Contains instructions about configuration, application programming, fault tracing and maintenance of Advant Controllers.
Software	PROFIBUS Library Editor User's Guide, 3BDS 100 585R1	Describes functions and usage of the PROFIBUS Library Editor supporting configuration of PROFIBUS devices in Advant system.
	Application Builder User's Guide, 3BSE 007 031R701	Installation of Advant Engineering components; operating instruction for APB and Advant Engineering support functions.
	Function Chart Builder User's Guide, 3BSE 007 149R801	Configuring, programming, and testing of targets by FCB.
	Data Base Elements Advant Controller 100 Series Reference Manual, 3BSE 000 505R401	Describes data base elements of Advant Controller 110.
	Data Base Elements Advant Controller 160 Reference Manual, 3BDS 005 556R101	Describes data base elements of Advant Controller 160.
Other	PROFIBUS Specification ⁽¹⁾ EN 50170 Volume 2 Edition 1.0 March 1998	PROFIBUS publication describing the normative parts of the PROFIBUS -FMS, -DP, -PA specification according to the European fieldbus standard EN 50 170.
	PROFIBUS Technical Guideline ⁽¹⁾ PROFIBUS-DP Extensions to EN 50170 (DPV1) Version 2.0, April 1998	PROFIBUS publication describing the DPV1 functionality as extension to the DP functions according to the EN 50 170 Volume 2.
	PROFIBUS Technical Guideline ⁽¹⁾ Installation Guideline for PROFIBUS-DP/FMS Version 1.0 September 1998	PROFIBUS publication describing common procedures to follow when specifying a PROFIBUS installation.
	www.profibus.com	PROFIBUS Internet site.

(1) Document can be subscribed by PNO.

1.6 Release History

Description and usage of the PROFIBUS Library Editor was part of the 1st and 2nd versions of this manual. Together with the release 1.7 of Advant Control Configuration, this part has been separated, updated and edited as a new user's guide instead.

1.7 Terminology

You should be familiar with the following terms associated with PROFIBUS-DP in Advant Controller 110 and Advant Controller 160:

Term	Description
ACC	AMPL Control Configuration
APB	Application Builder
EN 50170	European standard for PROFIBUS
FCB	Function Chart Builder
GSD file	Device Information ("Geräte StammDaten") file. A text file containing a description of the PROFIBUS slave, with a predetermined syntax. It is delivered with the slave or can be obtained from the manufacturer.
PDU	Protocol Data Unit, the PROFIBUS telegram
PLE	PROFIBUS Library Editor
PM	Processor Module (PM634 or PM644)
PNO	PROFIBUS User Organization
PROFIBUS-DP	Process Fieldbus - Decentralized Periphery. PROFIBUS protocol whose speciality is high speed, cyclic data communication.
PROFIBUS-DPV1	Process Fieldbus - Decentralized Periphery Extensions. PROFIBUS-DP protocol with extensions for acyclic data communication.
Slave	PROFIBUS slave (DP or DPV1). Device with binary or analog inputs/outputs, drives, valves, etc.

1.8 Product Overview

The PROFIBUS-DP interface in Advant Controller 110, respectively Advant Controller 160, allows to connect PROFIBUS slaves. It conforms with the PROFIBUS-DP standard EN 50170 and a subset of the extensions known as PROFIBUS-DPV1. Throughout this document the term PROFIBUS-DP is used for both, except where especially noted.

Traffic on a PROFIBUS link is controlled by a master station. Direct communication is possible only between the master (PM634, PM644) and the slaves. PROFIBUS in Advant Controller 110 /160 consists of three parts (see [Figure 1-2](#)):

1. The **PC program** (Process Control program), written in AMPL, is used to define and control the data flow on the link.

2. The Advant **DB Elements** are used to configure the communication interface within the Processor Module (PM634/PM644), and to define the PROFIBUS slaves. Further, it provides the connection to the process values.
3. Processor Module **PM634/PM644** runs the PROFIBUS-DP protocol in Advant Controller 110/160.

The Processor Module with PROFIBUS-DP interface is installed in the basic station of Advant Controller. It is equipped with one PROFIBUS-DP master interface. The setup of this link is defined by a number of data base elements (see [Section 3.6, Application Procedures](#)).

In Advant Controller 160 up to 6 Processor Modules of type PM644 can be installed in the basic station resulting in 6 independent PROFIBUS-DP lines.

The PROFIBUS link forms a local control network within the ABB Master system with the network numbers 1 to 9. Each I/O device may have a number from 0–125.

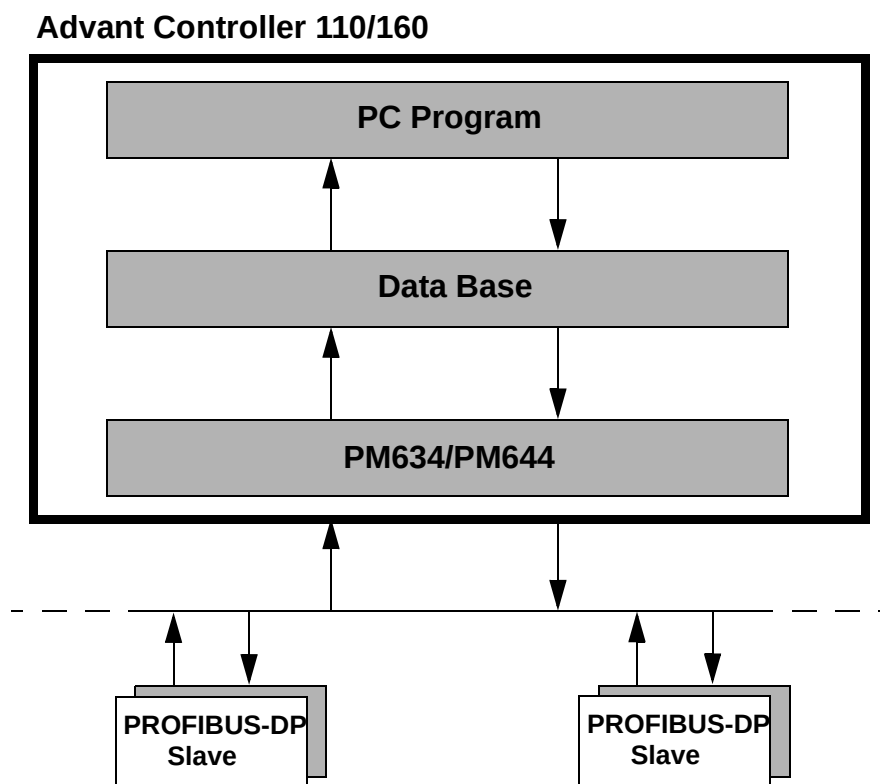


Figure 1-2. Overview of PROFIBUS in Advant Controller 110/160

1.8.1 Functionality

The following PROFIBUS-DP functions are implemented in the Processor Module with PROFIBUS-DP interface:

- Read and write process data
- Read diagnostic data from devices
- Supervise the PROFIBUS link.

For detailed information about the PROFIBUS protocol, see the norm EN 50170.

1.8.2 Functional Overview

To use PROFIBUS, you have to build application consisting of two main parts: the PC program and the data base (see [Figure 1-2](#)).

PC Program

Use the PC program to do the application specific logic and to monitor the status of the I/O devices.

Data Base

The necessary data base input for the Processor Module with PROFIBUS-DP interface (PM634, PM644) is defined with the Processor Module data base element and other configuration data base elements.

Those are:

- **PM634 / PM644**

Data base element for the *Processor Module* (provides the logical link to the PROFIBUS master DB element).

- **PROFIBUS master PB**

Data base element for *PROFIBUS Configuration* (defines the bus characteristics)

- **PROFIBUS I/O devices PBS**

Data base elements that are specific for the used hardware. They define the characteristics of each PROFIBUS-DP *I/O device* (address, vendor specific settings, and so on).

Data base elements represent compact slaves and modular slaves, and also modules and signals of the latter.

1.8.3 Data Transmission

In PROFIBUS-DP protocol the master addresses cyclically all connected slaves.

The master sends up to 244 bytes output data and receives up to 244 bytes of input data.

[Figure 1-3](#) shows this data transmission. Additionally there can be up to 244 bytes of diagnostic data from the slave.

The transmission of diagnostic data is requested by the slave when it sets the Slave_Diag flag. Then the master automatically fetches the diagnostic data.

The contents of the first six bytes in the diagnostic data PDU (Protocol Data Unit, the PROFIBUS telegram) are defined by the norm EN 50170. The remaining 238 bytes may be assigned by the manufacturer of the PROFIBUS slave device. These bytes are device specific.

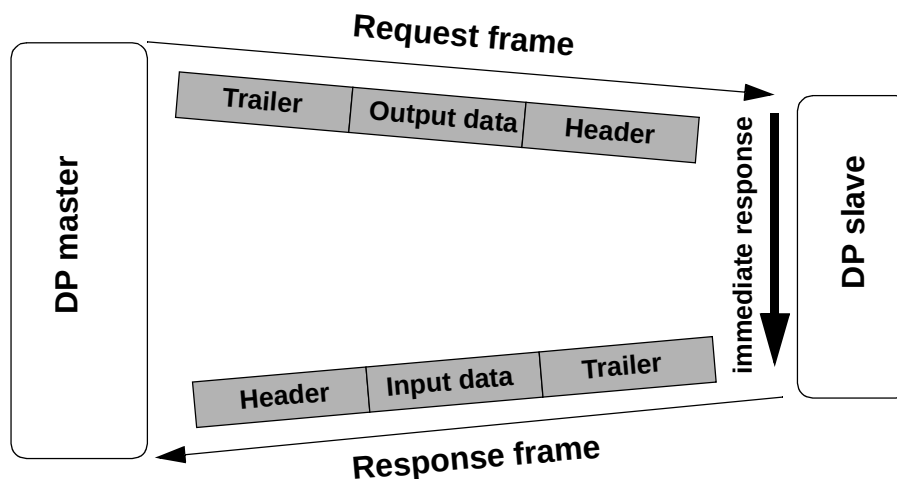


Figure 1-3. PROFIBUS-DP Data Transmission

1.9 User Interface

General

AMPL Control Configuration (32-bit applications running under Windows NT) serve as **tools for configuring and programming** of Advant Open Control Systems and Advant Open Control Products. AMPL Control Configuration consists of several components, such as Application Builder, Function Chart Builder, and of options, such as AMPL PC and DB Element Libraries to be installed separately.

Generally, data base elements (DB elements) represent different hardware elements and features, such as couplers, buses, and process I/O modules. Process control elements (PC elements) represent elementary and compound process control functions.

You setup your project and manage the objects (that is, nodes, type circuit, and circuits) belonging to a certain node type in the Application Builder.

For each object, you select element libraries in form of node type and options reflecting properties and capabilities of the corresponding Advant Controller 110 station, in which the application will run.

You configure and program your application with the Function Chart Builder:

- You build the data base part of your application by instantiating (that is, inserting one or several instances of) DB elements available in the selected DB element libraries.
- You build the program part by instantiating PC elements available in the selected PC element libraries.
- Then, you download the target code of the application to the node, start it, and test it.

PROFIBUS-DP Configurations

A PROFIBUS-DP configuration consists of two parts:

- The standardized part of PROFIBUS-DP master implemented by the Processor Module (PM634, PM644) with the integrated PROFIBUS-DP interface
- The variable part of PROFIBUS slaves implemented by different vendors. The latter are described by their GSD file.

In AMPL Control Configuration

- The PROFIBUS-DP master and the PROFIBUS-DP slave devices as types are represented by DB element types.
- The PROFIBUS-DP master and the PROFIBUS-DP slave devices are represented by DB element instances.

When you are working with AMPL Control Configuration, the following tools and resources are available to produce a PROFIBUS-DP DB element library which reflects the actual PROFIBUS-DP slaves, modules, and signals as applicable:

- Model element library containing only the description of the PROFIBUS master and a compact slave, the latter serving as template
- PROFIBUS Library Editor that allows to extend the model element library with the description of actual PROFIBUS slaves, modules, and signals.

The DB elements types created with the PROFIBUS Library Editor can be instantiated with the Function Chart Builder in the DB part of your Advant Controller applications.

Chapter 2 Installation

2.1 General

This chapter will guide you through the installation of the PROFIBUS interface in Advant Controller 110 or Advant Controller 160. The chapter focuses on physical installation of the PROFIBUS and not on system setup and configuration.

NOTE

It is recommended to use only certified PROFIBUS slaves, to ensure adherence of the slaves to the standard.

Certified PROFIBUS slaves, repeaters, connectors, cables and other PROFIBUS products can be found in the product catalog published by the PNO at www.profibus.com.

2.2 Site Planning

See the *ABB Master Installation Rules*, *Advant Controller 110 User's Guide*, or *Advant Controller 160 User's Guide* for guidelines on earth connection, power supply, etc.

2.3 Installation Procedures

Wiring

All devices are connected in a bus structure, that is, in a line. For load reasons this bus is divided into so-called segments. Up to 32 stations (master or slaves) can be connected in one segment. See [Figure 2-3](#) for the bus structure.

The bus is terminated by an active bus terminator at the beginning and end of each segment. See [Figure 2-2](#) for the bus termination and cabling.

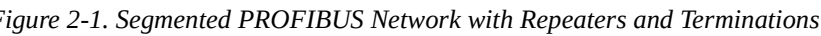
[Figure 2-2](#) shows a network structure that consists of three bus segments. The bus line starts at a master (1) and goes to two slave stations and a repeater (2). The repeater connects the first segment to a second one, which in turn has one slave and a second repeater (3) connected. This last repeater then drives the third bus segment.

To ensure error free operation, both bus terminations must always be powered.

NOTE

Many vendors have designed a switchable bus termination in their devices or plug connectors.

When more than 32 devices are used, repeaters (line amplifiers) must be used to connect the bus segments. A maximum of 3 repeaters between two stations is permissible.



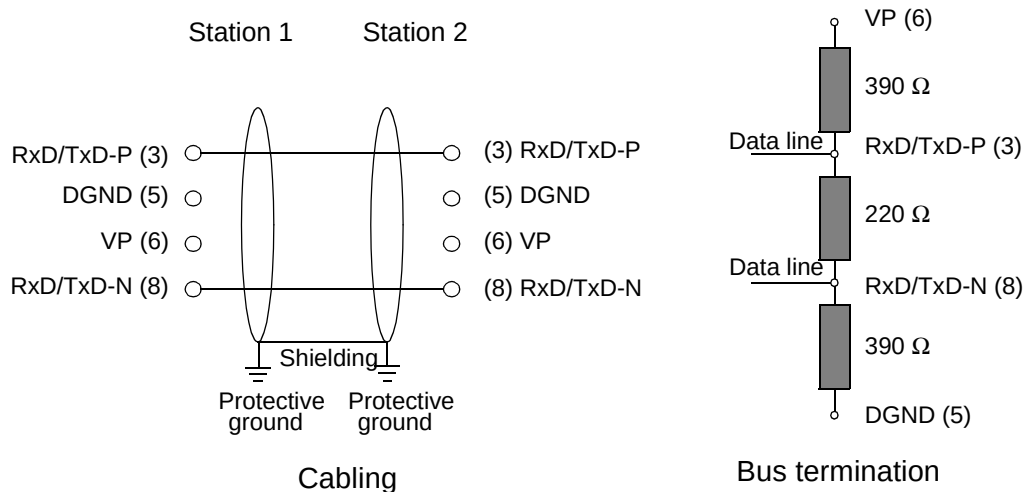


Figure 2-2. Cabling and Bus Termination

The maximum cable length depends on the transmission speed. See [Table 2-1](#) and [Table 2-2](#). The specified cable length can be increased by the use of repeaters.

Table 2-1. Distances based on Transmission Speed for Type A Cable⁽¹⁾

Baud rate (kbit/sec)	9.6	19.2	93.75	187.5	500	1500	3000	6000	12000
Segment length (m)	1200	1200	1200	1000	400	200	100	100	100

(1) see [Table 2-3](#)

Table 2-2. Distances based on Transmission Speed for Type B Cable⁽¹⁾

Baud rate (kbit/sec)	9.6	19.2	93.75	187.5	500	1500	3000	6000	12000
Segment length (m)	1200	1200	1200	600	200	—	—	—	—

(1) see [Table 2-3](#)

Use of a 9-pin D sub plug connector is preferred for PROFIBUS networks using RS 485 transmission technology. The pin assignment of the plug connector and the wiring are shown in [Figure 2-2](#).

Due to the capacitive load of the station and the line reflection generated, the following connection plug combination must be used for products which are operated with high Baud rates (i.e., greater than 1500 kbit/sec):

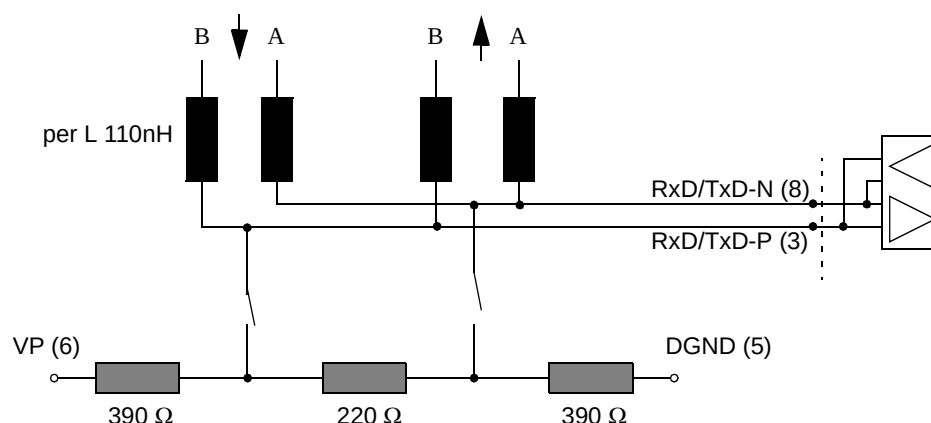


Figure 2-3. Cabling and Bus Termination for Baud Rates > 1500 kbit/sec

Dimensioning of the longitudinal inductivity of $L = 110 \text{ nH}$ was based on the following connection parameters:

- Cable type A.
- Typical connection capacity of a bus station (e.g., plug connectors, line length to the RS 485 driver, RS 485 driver, components, etc.): 15 to 25 pF.

Shielding

EN 50170 leaves it to the user if a shielded or unshielded cable shall be used. In areas with no disturbances unshielded cable is permitted. The following reasons however make it advisable to use a shielded cable:

- An area free of disturbances will only exist inside of a shielded cabinet. As soon as a relay is mounted into the cabinet non interference is no longer ensured.
- The use of unshielded cables requires additional protection mechanisms at the bus signal inputs against overvoltage.

Therefore it is recommended to use always shielded cable.

This recommendation is also applicable for eventually needed supply cables from external power supplies to the PROFIBUS devices. (e.g., repeaters). Double shielded lines are especially suitable for surroundings with heavy electromagnetic interference. In order to guarantee optimal protection the outer shield (shielding braid) and the inner shield (shielding foil) should be connected to ground on both cable ends flatly with a ground termination clip.

Shielding Rules

When using a shielded bus cable it is recommended to connect the shield on both sides low inductively with the protective ground in order to achieve optimal electromagnetic compatibility. In case of separate potentials, for example, in refinery, the shield should be connected only at one side of the bus cable to the protective ground.

Preferably the connections between the cable shield and the protective ground (for example, the metallic station housing) should be made via the metallic housings and the metallic fixing screws of the D-sub connectors. If this is not possible the pin 1 of the connectors may be used.

NOTE

For the Processor Module which is always mounted in a cabinet, the recommended solution for shielding is described in the *Advant Controller 110 User's Guide* respectively the *Advant Controller 160 User's Guide*, Section Grounding of Communication Cable Shields, see [Figure 2-4](#). Note that pin 1 cannot be used for shielding. For site planning it is recommended to read the PROFIBUS Technical Guideline *Installation Guideline for PROFIBUS-DP/FMS*.

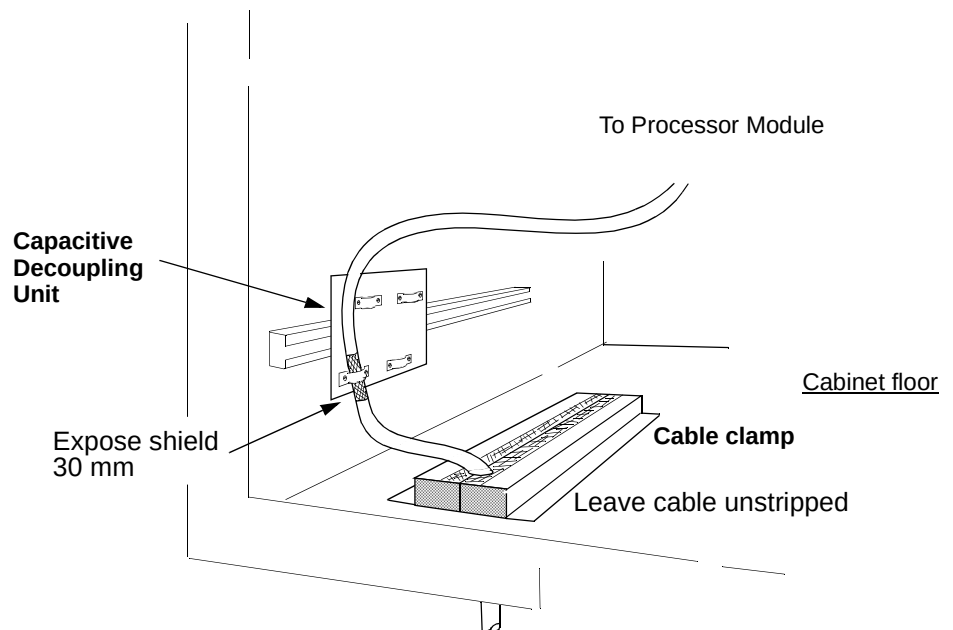


Figure 2-4. Communication Cable Shield Grounded by Capacitor

For site planning it is recommended to read the PROFIBUS Technical Guideline *Installation Guideline for PROFIBUS-DP/FMS*.

Bus Cable

The PROFIBUS standard defines two variants of the bus cable for PROFIBUS-DP. Type A is especially recommended for high transmission speeds (> 500 kBaud) and permits doubling of the network distance in comparison to Type B. Type B should only be used at low baud rates and low requirements on the network distances.

NOTE

It is recommended to use only cable type A.

Table 2-3. Cable Specification Type A for PROFIBUS-DP

Characteristics	Value/Description
Impedance	135 up to 165 Ω at a frequency of 3 to 20 MHz.
Cable capacity	< 30 pF per Meter
Core diameter	> 0.34 mm ² , corresponds to AWG 22
Cable type	twisted pair cable. 1×2 or 2×2 or 1×4 lines
Resistance	< 110 Ω per km
Signal attenuation	max. 9 dB over total length of line section
Shielding	CU shielding braid or shielding braid and shielding foil

Table 2-4. Cable Specification Type B for PROFIBUS-DP

Characteristics	Value/Description
Impedance	135 up to 165 Ω at a frequency of > 100 kHz
Cable capacity	typ. < 60 pF per Meter
Core diameter	> 0.22 mm ² , corresponds to AWG 24
Cable type	twisted pair cable. 1×2, 2×2, or 1×4 lines
Resistance	—
Signal attenuation	max. 9 dB over total length of line section
Shielding	CU shielding braid or shielding braid and shielding foil

2.4 Start-up Procedures

To start the PROFIBUS application load the application program in the controller, save it into PROM. Set the Processor Module's start mode switch either in position AUTO or CLEAR and deblock the program.

The PROFIBUS interface will be configured during the loading process and the PROFIBUS communication is started, as indicated by the R(un) LED of the PROFIBUS interface. It will then automatically scan all configured slaves and checks whether their actual settings are the same as specified in the database. Only successful configured slaves go into data exchange mode.

After deblocking of the PC program the process values are transmitted to and from the PROFIBUS slaves.

2.5 Shut-down Procedures

A PROFIBUS application on Advant Controller is stopped whenever the user either blocks the program or resets the Processor Module with the start mode switch in position “1” (STOP).

The PROFIBUS communication itself is stopped during the reconfiguration of the PROFIBUS interface (e.g., the application program is reloaded) or the reset of the Processor Module.

Chapter 3 Configuration/Application Building

3.1 Considerations

If you want to set up the DB elements that are necessary to configure the PROFIBUS-DP link, you need the following information:

1. How shall the network be configured?
 - Network number
 - Node numbers of all stations on the PROFIBUS-DP
 - Slaves to be used.
2. What are the line characteristics?

PROFIBUS-DP bus characteristics
Specify the speed and the various timing parameters if these require non-standard settings. This might be the case for some special I/O devices. The timings are usually given in units of bit-time, t_{BIT} .
3. Which DB elements do you need?

Create DB element types for the PROFIBUS-DP slaves by the PROFIBUS Library Editor. You will need the GSD file for each slave to do that.

See [Section 3.6, Application Procedures](#), for a complete checklist.

3.2 Capacity

- Advant Controller 110 supports one PROFIBUS-DP line, Advant Controller 160 supports up to 6 PROFIBUS lines, when 6× PM644 are used in a Basic Station.
- A maximum of 126 PROFIBUS-DP devices is allowed. This figure includes all necessary repeaters.
- A bus segment can handle up to 32 PROFIBUS-DP devices, including the repeater to another bus segment.
- Transmissions speeds may range from 9600 bit/s up to 12 Mbit/s.

3.3 Data Base Configuration

The data base necessary for PROFIBUS-DP configuration is defined with the following DB element instances:

- PM634 / PM644
- PB
- Slave elements and—in case of modular slaves—their module and signal elements (These device dependent types can be created with the PROFIBUS Library Editor).

In the next figure the hierarchy of these DB elements is shown.

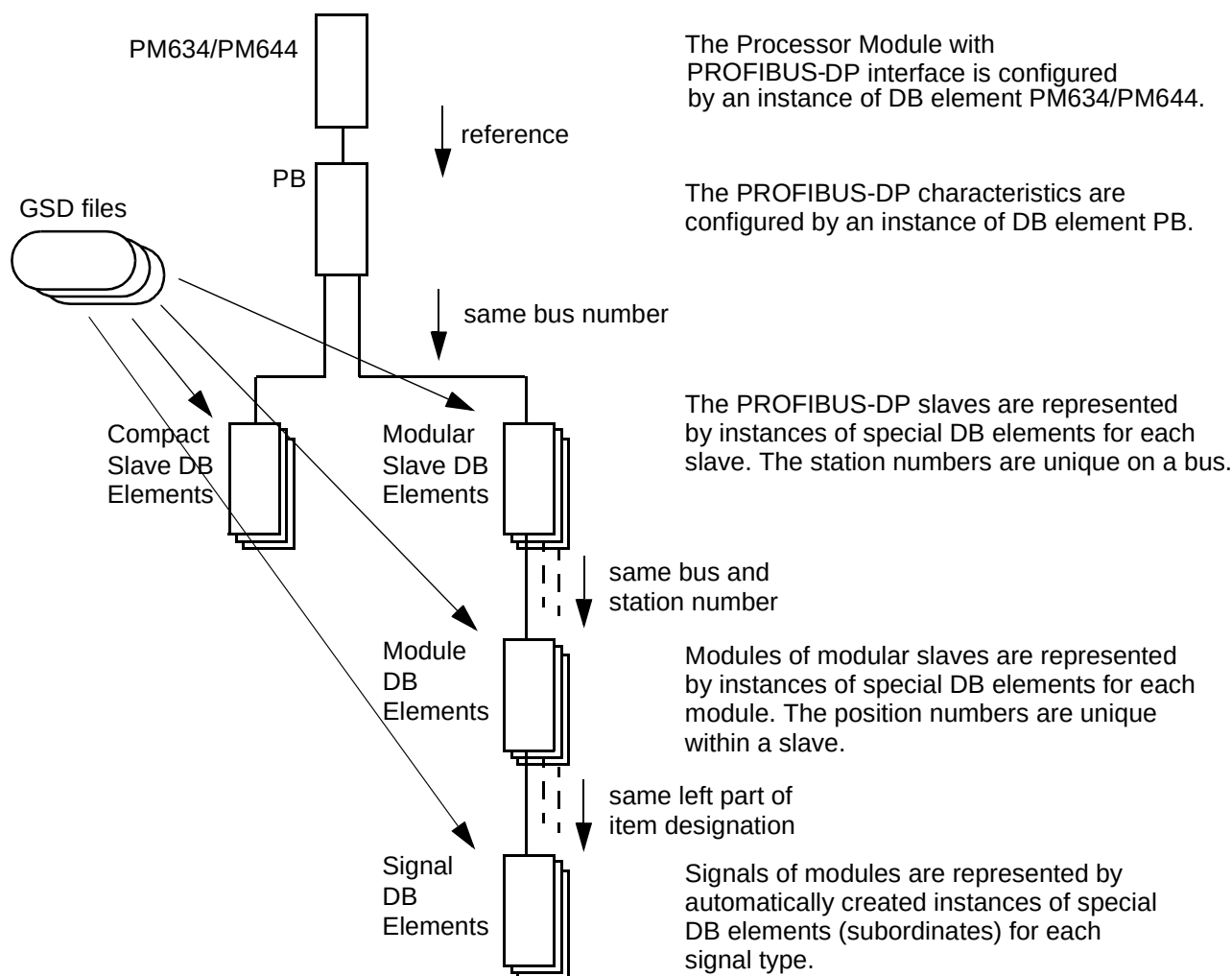


Figure 3-1. Hierarchy of DB Elements for PROFIBUS-DP Configurations

3.4 Application Start-up

To build an application for an Advant Controller 110 system with PROFIBUS-DP, you need Advant Control Configuration 1.6 or higher. For Advant Controller 160 with PROFIBUS-DP you need Advant Control Configuration 1.8 or higher. The main steps to start up the PROFIBUS-DP link:

1. Be sure the DB element types representing the PROFIBUS-DP devices of the application are available in the DB element library.
If some DB element types are missing, create them by the PROFIBUS Library Editor and update the DB element library. See *PROFIBUS Library Editor User's Guide*.

2. Build the data base of the application. Here you instantiate DB elements representing the PROFIBUS-DP devices of the application. Build the PC program of the application. See [Section 3.6, Application Procedures](#).
3. When the application data base and PC program are ready, generate target code and start up the communication link as described in [Section 2.4, Start-up Procedures](#).

3.5 Tutorial

3.5.1 Overview

This section describes how to configure a sample Advant Controller 110 system using PROFIBUS-DP. Advant Controller 160 is configured in the same way. It is supposed that all DB element types are available in the DB element library that are necessary for the representation of the PROFIBUS-DP devices of the application. In due case, create the missing DB element types and add them to the DB element library. See *PROFIBUS Library Editor User's Guide*.

[Figure 3-2](#) shows a sample system.

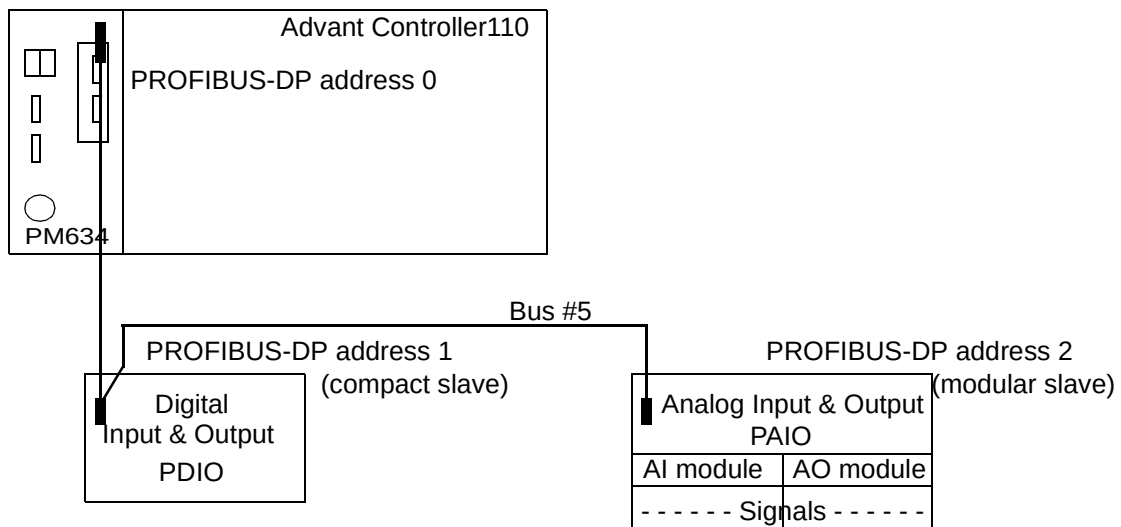


Figure 3-2. Configuration of Sample System

The configuration comprises an Advant Controller 110 basic station and 2 fictitious PROFIBUS-DP I/O devices, PDIO and PAIO, respectively.

The PDIO device handles 2 digital inputs as well as 2 digital outputs, it will be configured as a compact slave. The PAIO device handles 16 analog inputs and 16 analog outputs, it will be configured as a modular slave consisting of two modules each comprising 16 signals. Both I/O devices offer extended diagnostic bytes.

In the example, the bus is configured with the logical bus number 5 while the Advant Controller 110 has the station number 0 on that bus. It runs with 500 kBit/s and uses the standard timing values as specified by EN 50170.

The PC program of the application and the non-PROFIBUS-related parts of the data base do not have any peculiarities. In this tutorial we show only the DB element instances relevant for the PROFIBUS-DP configuration.

3.5.2 PROFIBUS-DP Master

Advant Controller 110

For Advant Controller 110 enter the following values to configure the Processor Module PM634 to serve as PROFIBUS-DP master:

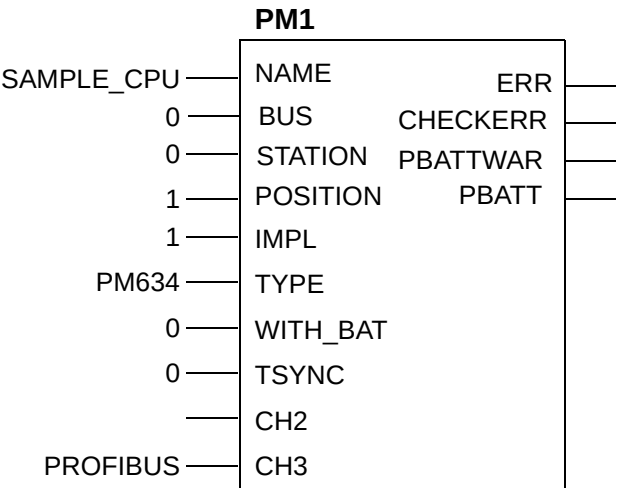


Figure 3-3. DB Element PM634

Advant Controller 160

For Advant Controller 160 enter the following values to configure the Processor Module PM644 to serve as PROFIBUS-DP master:

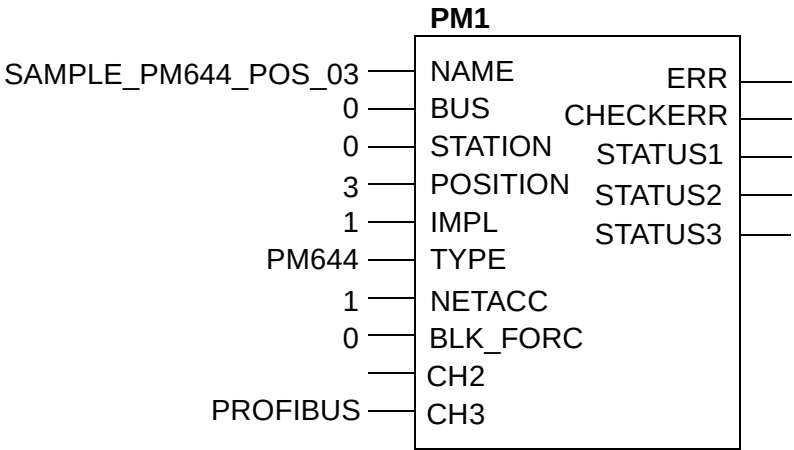


Figure 3-4. DB Element PM644

The reference “PROFIBUS” at terminal CH3 connects the Processor Module with the Data Base element PB1, shown below. All other terminal settings shown are examples only and must be adapted to your actual application.

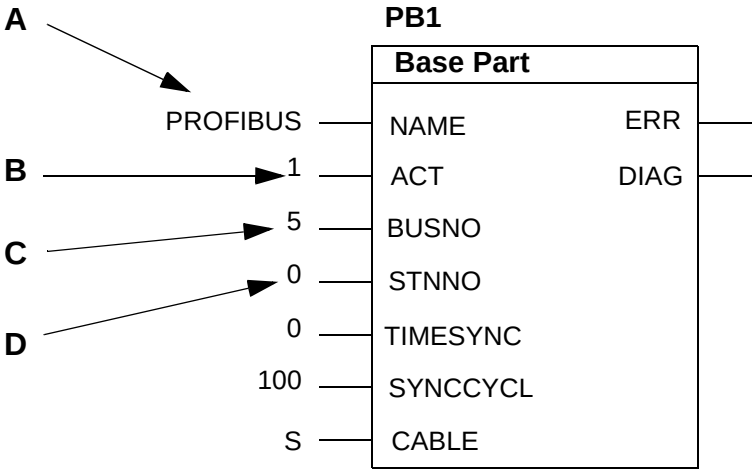


Figure 3-5. DB Element PB, Base Part

The string “PROFIBUS” at the NAME terminal is an arbitrary name. It is also used to make the reference from the Processor Module Data Base element (PM634/PM644).

The bus is active (B) and has the logical bus number 5 (C). The own station number is set to 0 (D).

The remaining terminals CABLE, TIMESYNC, and SYNCCYCL are set to the default values since their functionality is not supported with this version of Advant Controller.

The terminal ERR reflects the state of the PROFIBUS-DP coupler. It is set to 0 if the state is normal and to 1 otherwise.

The DIAG terminal gives more detailed info about the coupler's state.

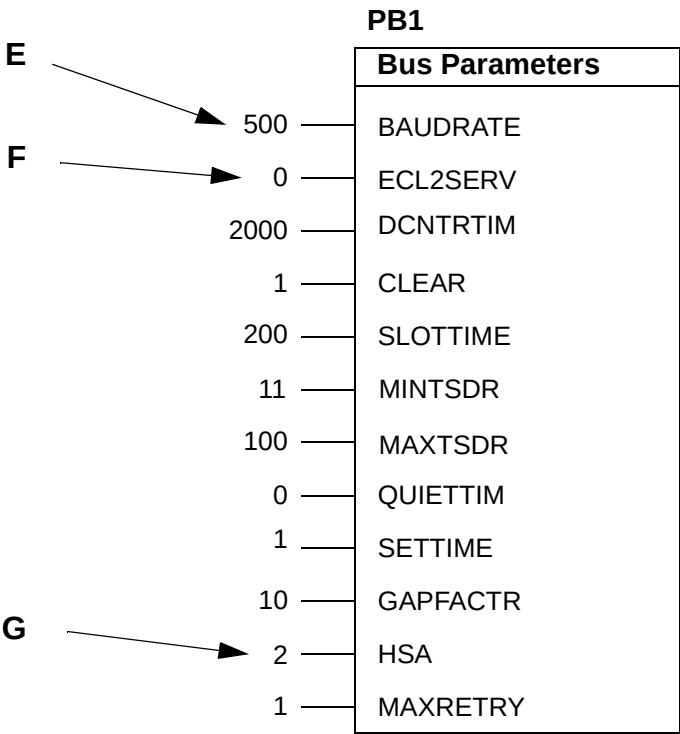


Figure 3-6. DB Element PB, Bus Parameters

The bus speed is selected at the BAUDRATE terminal (E).

A Class 2 server is not allowed to access the PROFIBUS-DP class 1 master (F).

Since we have only two PROFIBUS-DP slaves and one master connected to the bus, the highest station address is set to 2 (G). Thus the PROFIBUS-DP can operate at its maximum speed without permanently checking for other slaves that are not on the bus.

All timing parameters are left at their default values as specified by EN 50 170. However, these depend on the actual PROFIBUS-DP devices in your application. Consult the manufacturer's documentation to see whether the standard values are acceptable.

3.5.3 PROFIBUS-DP Slaves

3.5.3.1 PDIO, a Compact Slave

The PROFIBUS-DP slave that is represented by the DB Element PBS1 is connected to the logical bus number 5 (A). This must correspond to the value of the BUSNO terminal of the DB element PB1 above.

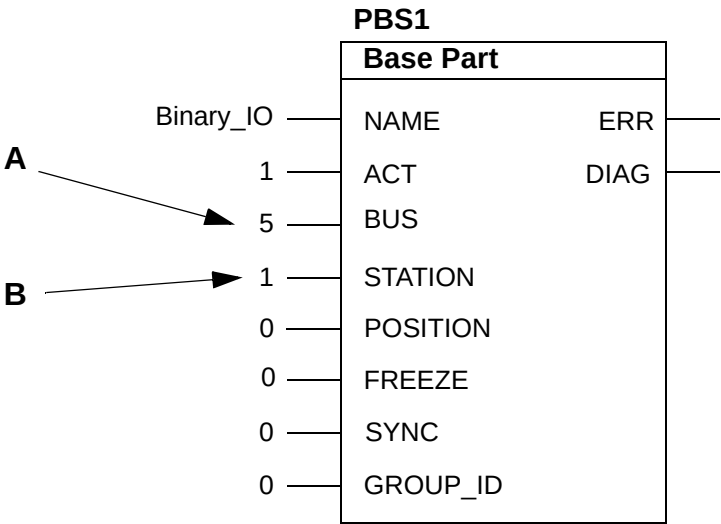


Figure 3-7. PDIO, DB Element PBS1, Base Part

The PROFIBUS-DP address for that slave is 1 as specified at the STATION terminal (B). This number must coincide with the actual setting of the address switch at the PROFIBUS-DP slave.

The terminal POSITION has the value 0, it cannot be edited.

The terminals FREEZE, SYNC and GROUP_ID are not supported by the current PROFIBUS-DP interface and are set to 0.

PROFIBUS-DP defines 6 standard diagnostic bytes. Bytes 1, 2, and 3 contain bits relevant for the station status. See list below. The manufacturer can define further specific diagnostic bytes.

The boolean terminal ERR shows the summary error built by ORing the listed bits logically.

If the terminal DIAG has the value 1, it shows that the slave diagnostic information—no matter whether in any of the standard or specific diagnostic bytes—has changed.

In that case you can read the diagnostic data at the slave-specific diagnostic outputs of the DB element. See process terminals of PDIO later.

The bits of the diagnostics byte relevant for station status have the following meaning:

Diagnostics Byte 1 (Station Status 1)

Bit 0: Diag.Station_Not_Exist	The master sets this bit when the slave does not exist.
Bit 1: Diag.Station_Not_Ready	The slave sets this bit when it is not ready for data exchange.
Bit 2: Diag.Cfg_Fault	Set by the slave when the received configuration data does not match the actual configuration.
Bit 3: Diag.Ext_Diag	Set by the slave if extended diagnostics data is available. The actual usage of this bit depends on the slave's manufacturer.
Bit 4: Diag.Not_Supported	Set by the slave if a non existing function is requested. For example, Sync/Freeze.
Bit 6: Diag.Prm_Fault	Set by the slave if the parameter data is invalid.
Bit 7: Diag.Master_Lock	The master sets this bit when the slave is parametrized by another master.

Diagnostics Byte 2 (Station Status 2)

Bit 0: Diag.Prm_Req	The slave sets this bit when it requests new parametrization.
---------------------	---

Diagnostics Byte 3 (Station Status 3)

Bit 7: Diag.Ext_Diag_Overflow The slave sets this bit when there are more diagnostic information data as specified in Ext_Diag_Data.
 The master can set this bit, too, when the slave sends more diagnostics information than the master is able to process.

The basic characteristics of the PROFIBUS-DP slave are defined in the Slave Parameters window of the DB element PBS1:

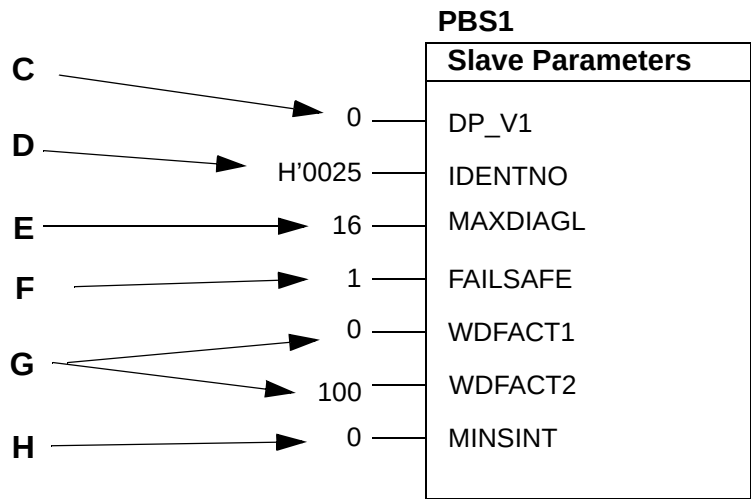


Figure 3-8. PDIO, DB Element PBS1, Slave Parameters

Our fictitious PROFIBUS-DP device is a standard device without the extended capabilities of DP_V1 (C).

It has the ident number 25 (D), taken from the GSD file at the keyword Ident_Number.

The terminal MAXDIAGL specifies that the maximum length of the device's diagnostic data in this example is 16 (E). You can find this figure in the GSD file at the keyword Max_Diag_Data_Len.

Note that this entry in the GSD file is not mandatory for PROFIBUS-DP devices conforming to EN 50 170 (as opposed to DPV1). If there is none in your specific GSD file choose a value of which you assume that it is big enough. The device will not enter operational mode if this value is too small.

The master is instructed to set the slave outputs to 0 when it goes to the passive state (F). This happens for instance when the master is reconfigured.

The terminals WDFACT1 and WDFACT2 define the watchdog time-out that the PROFIBUS-DP device uses to supervise the communication (G).

The time-out value is calculated as
$$T = WDFACT1 \times WDFACT2 \times 10 \text{ ms}$$

A time-out value of 0 means that there will be no time-out supervision.
The master is told how fast it may access the slave with the terminal MINSINT (minimum slave interval) (H).
The User_Prm_Data settings are also taken from the GSD file.
Their display is tailored according to User_Prm_Data_Len.

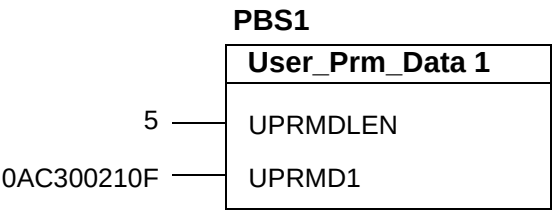


Figure 3-9. PDIO, DB Element PBS1, User_Prm_Data

See the keyword User_Prm_Data in the GSD file. It contains a number of hexadecimal bytes that are used to configure the PROFIBUS-DP master.
The parameter UPRMDLEN gives the total number of bytes which are entered at the UPRMD* terminals. The FCB checks at target code generation time whether this value is correct by comparing it with the number of bytes actually entered. If the numbers do not match, an error message is given and the application will not be loadable.
The Cfg_Data settings are taken from the GSD file that the manufacturer of the PROFIBUS-DP device delivers. Their display is tailored according to Cfg_Data_Len.

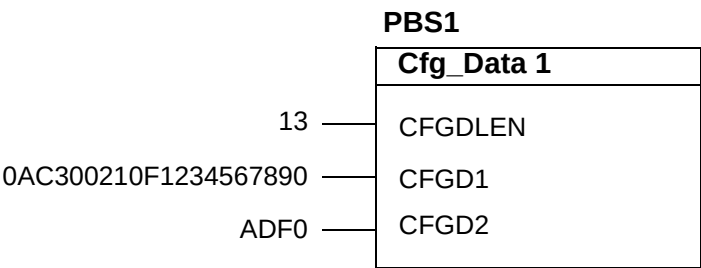


Figure 3-10. PDIO, DB Element PBS1, Cfg_Data

See the keyword Config in the GSD file. It contains a number of hexadecimal bytes that are used to perform a check whether the addressed device matches the description in the master. The slave will not enter the operational state if this check fails.
The parameter CFGDLEN gives the total number of bytes which are entered at the CFGD* terminals. The FCB checks at target code generation time whether this value is correct by

comparing it with the number of bytes actually entered. If the numbers do not match, an error message is given and the application will not be loadable.

The terminals in the Process Values window of DB element PBS1 provide the connections of the values from and to the PROFIBUS-DP slave to the PC part of your application program.

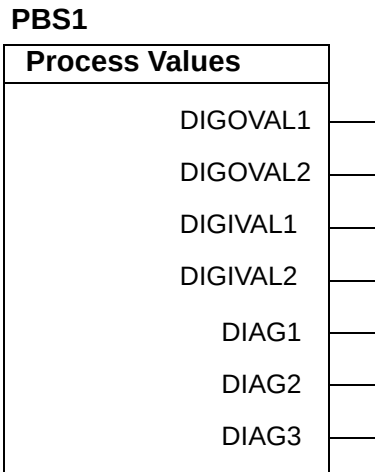


Figure 3-11. PDIO, DB Element PBS1, Process Values

DIGOVAL* are the digital output process value terminals.

DIGIVAL* are the digital input process value terminals.

DIAG* are the diagnostic value terminals reflecting station status bytes 1, 2, and 3.

The contents also of this window are specified using the PROFIBUS Library Editor.

With the PROFIBUS Library Editor you specified which value of that slave device will show up at which terminal of the DB element type PDIO.

3.5.3.2 PAIO, a Modular Slave

The modular slave is represented by a DB element for the modular slave itself, by one or several DB elements for the modules, and generally by several DB elements for the signals.

The representation of PROFIBUS-DP devices as modular slaves allows referencing process signals by instance name of the signal DB elements or symbolic instance names and programming independently of I/O hardware configuration. So you can handle the process signals of PROFIBUS-DP devices in the same way as the ones of S600 I/O and S800 I/O, and you can use extended DB elements in conjunction with PROFIBUS-DP devices.

NOTE

A PROFIBUS-DP device is defined as modular or compact slave in its GSD file by its manufacturer. The PROFIBUS Library Editor generates DB element types accordingly. Nevertheless, in order to profit from advantages of signal referencing by name or symbol, it is allowed and supported to represent a compact slave as a modular slave by DB element types.

In our example, the PAIO device has one analog input module handling 16 analog input signals and one output module handling 16 analog output signals.

When configuring the DB part of the application, you have to instantiate accordingly the DB elements for the slave, then the DB elements for its modules. The signal DB elements will be instantiated automatically as subordinates together with the instantiation of module DB elements.

Modular Slave

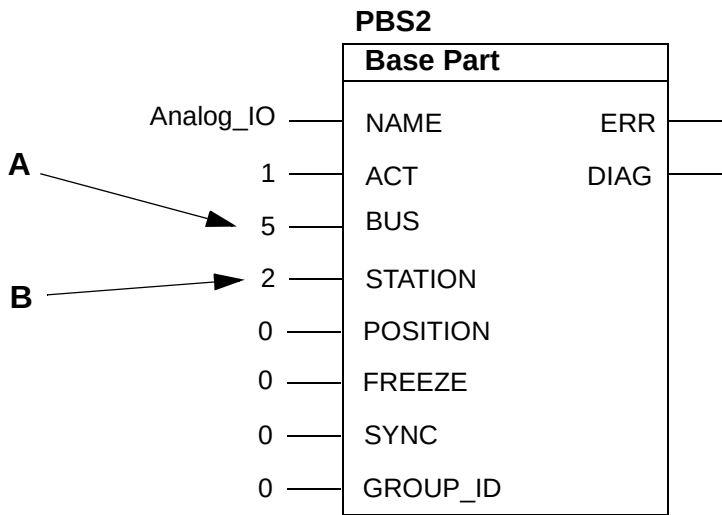


Figure 3-12. PAIO, DB Element PBS2, Base Part

The PROFIBUS-DP slave for analog values has the PROFIBUS-DP address 2 (B). This number must coincide with the actual setting of the address switch at the PROFIBUS-DP slave. The setting of the bus terminal is the same as on the PB and PDIO elements (A).

The terminal POSITION has the value 0, it cannot be edited.

The terminals FREEZE, SYNC and GROUP_ID are not supported by the current PROFIBUS-DP interface and are set to 0.

The terminal ERR shows the summary error condition of PAIO and its subordinates. The station status relevant bits of the diagnostic bytes are logically ORed to yield value of ERR. See [Section 3.5.3.1, PDIO, a Compact Slave](#) for status bits.

If the terminal DIAG has the value 1, it shows that the slave diagnostic information—no matter whether in any of the standard or specific diagnostic bytes—has changed. In that case you can read the diagnostic data at the slave-specific diagnostic outputs of the DB element. See process terminals of PAIO later.

The terminal ERR reflects summary error condition of PAIO and its subordinates.

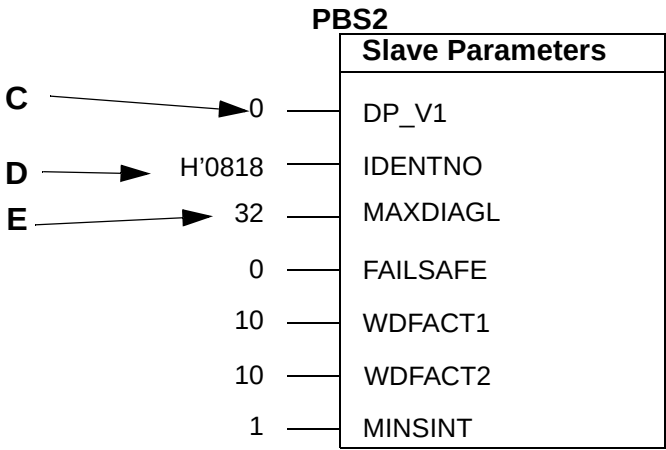


Figure 3-13. PAIO, DB Element PBS2, Slave Parameters

PAIO is a standard PROFIBUS-DP device without the extended capabilities of DP_V1 (C). It has the ident number H'0818 (D, hexadecimal notation), taken from the GSD file at the keyword Ident_Number. The value for MAXDIAGL, 32 (E) is taken from the GSD file. The User_Prm_Data settings are taken from the GSD file. Their display is tailored according to User_Prm_Data_Len.

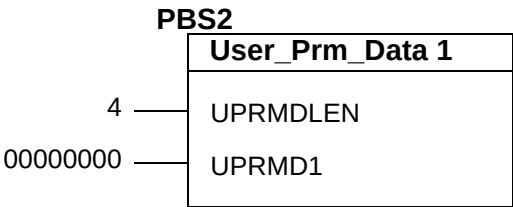


Figure 3-14. PAIO, DB Element PBS2, User_Prm_Data

The GSD file specifies the Cfg_Data settings and their display similarly:

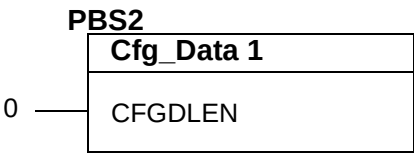


Figure 3-15. PAIO, DB Element PBS2, Cfg_Data

The Cfg_Data settings are taken from the GSD file that the manufacturer of the PROFIBUS-DP device delivers. See the keyword Config in the GSD file. It contains a number of hexadecimal

bytes that are used to perform a check whether the addresses device matches the description in the master. The slave will not enter the operational state if this check fails.

The parameter CFGDLEN gives the total number of bytes which are entered at the CFGD* terminals. The FCB checks at target code generation time whether this value is correct by comparing it with the number of bytes actually entered. If the numbers do not match, an error message is given and the application will not be loadable.

Terminals of Process Values window of DB element PBS2 provide the connections to the actual diagnostic values from the PROFIBUS-DP slave to the PC part of your application program.

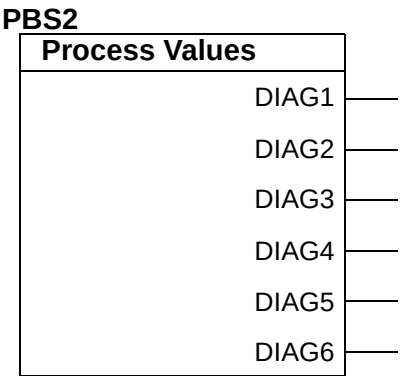


Figure 3-16. PAIO, DB Element PBS2, Process Values

Analog Input Module

The modular slave PAIO has one analog input module AIPB1 as subordinate that contains—in our example—16 analog input signals.

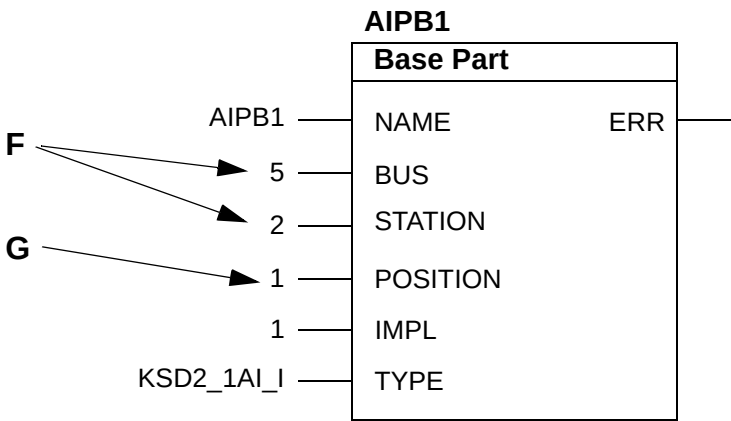


Figure 3-17. PAIO, Module DB Element AIPB1, Base Part

The module has the same address as the modular slave 2 (F). It must coincide with the actual setting of the address switch at the PROFIBUS-DP slave.

The setting of the POSITION terminal (G) describes the relative position of process data of the signals in the response frame at data transmission over the PROFIBUS.

TYPE is taken from the GSD file.

The terminal ERR shows the summary error condition of AIPB1 and its subordinate signals.

The module has its own User_Prm_Data 1 and Cfg_Data 1 settings:

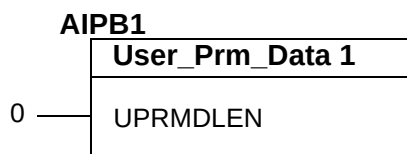


Figure 3-18. PAIO, Module DB Element AIPB1, User_Prm_Data

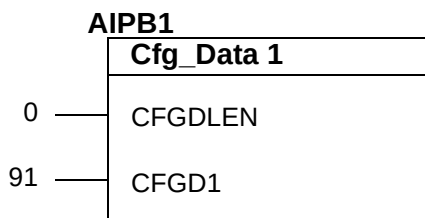


Figure 3-19. PAIO, Module DB Element AIPB1, Cfg_Data

Analog Input Signals

The analog input signal DB elements AIPB1.1 to AIPB1.16 are instantiated automatically together with the analog input module DB element AIPB1.

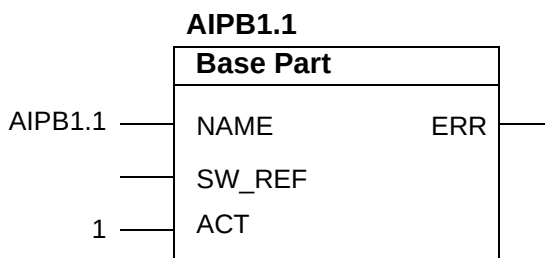


Figure 3-20. PAIO, Signal DB Element AIPB1.1, Base Part

The SW_REF terminal cannot be written. It will be filled automatically if an extended DB element references AIPB1.1.

The ACT terminal cannot be written.

The terminal ERR shows error condition of AIPB1.1 signal.

The signal has its own—in our example empty—User_Prm_Data 1 and Cfg_Data 1 settings:

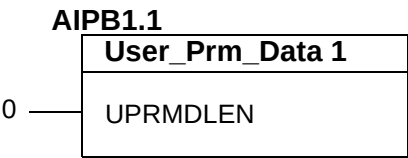


Figure 3-21. PAIO, Signal DB Element AIPB1.1, User_Prm_Data

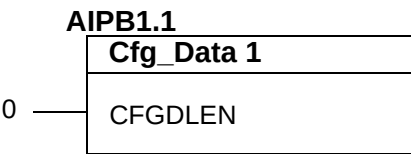


Figure 3-22. PAIO, Signal DB Element AIPB1.1, Cfg_Data

The terminal in the Process Values window provides the connection from and to the PC part of your application program.

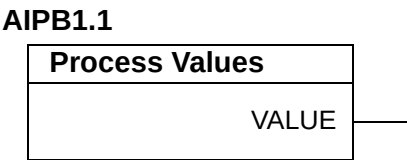


Figure 3-23. PAIO, Signal DB Element AIPB1.1, Process Values

Analog Output Module

The modular slave PAIO has one analog output module AOPB1 that contains—in our example—16 analog output signals.

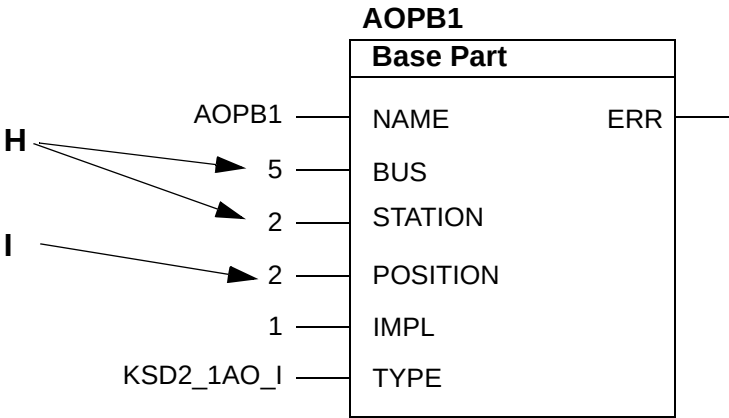


Figure 3-24. PAIO, Module DB Element AOPB1, Base Part

The module has the same address as the modular slave 2 (H). It must coincide with the actual setting of the address switch at the PROFIBUS-DP slave. The setting of the POSITION (I) describes the relative position of process data of the signals in the response frame at data transmission over the PROFIBUS.

TYPE is taken from the GSD file.

The terminal ERR shows the summary error condition of AOPB1 and its subordinate signals.

The module has its own User_Prm_Data 1 and Cfg_Data 1 settings:

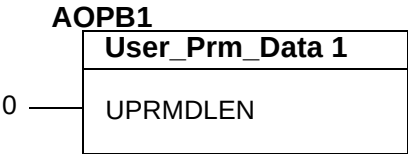


Figure 3-25. PAIO, Module DB Element AOPB1, User_Prm_Data

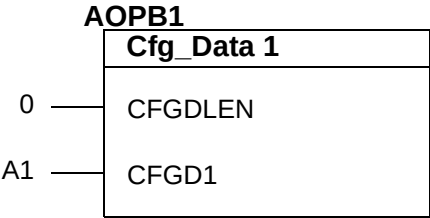


Figure 3-26. PAIO, Module DB Element AOPB1, Cfg_Data

Analog Output Signals

The analog output signal DB elements AOPB1.1 to AOPB1.16 are instantiated automatically together with the analog output module DB element AOPB1.

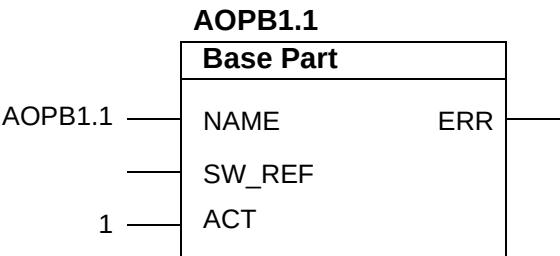


Figure 3-27. PDIO, Signal DB Element AOPB1.1, Base Part

The SW_REF terminal cannot be written. It will be filled automatically if an extended DB element references AOPB1.1.

The ACT terminal cannot be written.

The terminal ERR shows error condition of AOPB1.1 signal.

The signal has its own—in our example empty—User_Prm_Data 1 and Cfg_Data 1 settings:

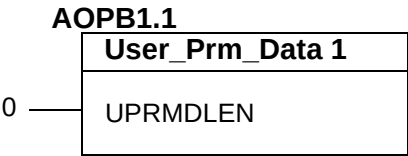


Figure 3-28. PAIO, Signal DB Element AOPB1.1, User_Prm_Data

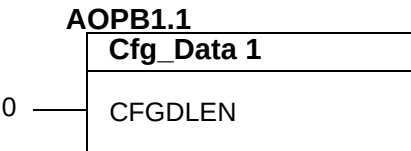


Figure 3-29. PAIO, Signal DB Element AOPB1.1, Cfg_Data

The terminal in the Process Values window provides the connection from and to the PC part of your application program.

AOPB1.1

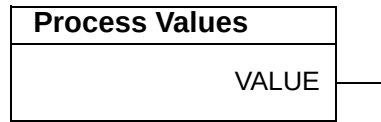


Figure 3-30. PAIO, Signal DB Element AOPB1.1, Process Values

3.6 Application Procedures

This is a checklist of the necessary steps to build the application data base and PC program for the PROFIBUS-DP communication in Advant Controller 110 respectively Advant Controller 160.

Table 3-1. Checklist for PROFIBUS-DP Applications

No	Issue	OK
1	Define the network number for the PROFIBUS-DP line.	
2	Specify the PROFIBUS-DP bus characteristics, such as speed and various timing parameters if these require non-standard settings. This might be the case for some special I/O devices. The timings are usually given in units of bit-time, t_{BIT}	
3	Define the number, kind, and type of PROFIBUS-DP slaves to be used.	
4	Get the GSD file for each slave (and module and signal) type.	
5	Define the node numbers for all slaves, that is, their address on the PROFIBUS-DP bus.	
6	Check that the DB element library contains the necessary DB element types. If not, - Create a DB element type for each PROFIBUS-DP slave (and module and signal) type by using PROFIBUS Library Editor. - Make the new DB element types available for the Function Chart Builder by using Setup Add-Ons.	
7	In Function Chart Builder, instantiate and configure the Processor Module DB element (PM634 or PM644).	
8	Check whether any of the slaves needs an unusual timing.	
9	Instantiate and configure DB element PB.	
10	Instantiate and configure slave elements and their subordinates as applicable.	
11	Define the cycle time of your control modules.	
12	Build the control module, program the PC part.	
13	Generate target code and load it to the target system.	
14	Test the application.	

3.7 Configuration of Application Data Base

3.7.1 Data Base Element PROFIBUS-DP

Summary

The PROFIBUS-DP data base element specifies the interface to PROFIBUS-DP. The element contains configuration as well as diagnostic information.

Overview

PROFIBUS-DP : ▼

▼

NAME	ERR
ACT	DIAG
BUSNO	
STNNO	
TIMESYNC	
SYNCCYCL	
CABLE	

BAUDRATE
ECL2SERV
DCNTRTIM
CLEAR
SLOTTIME
MINTSDR
MAXTSDR
QUIETTIM
SETTIME
GAPFACTR
HSA
MAXRETRY

Base part

Edit DB Terminal Values - PB1

PROFIBUS-DP : ▼

PB1	NAME	ERR
1	ACT	DIAG
0	BUSNO	
0	STNNO	
0	TIMESYNC	
100	SYNCCYCL	
S	CABLE	

Terminal Description, Base part

Terminal Name	Allowed Values	Recommended Value	Description
NAME		PBx	Unique NAME of the bus.
ACT		1	Element is: 0=spare, 1= ACT ive
BUSNO	0-255 ⁽¹⁾		Unique BUS Number for this fieldbus.
STNNO	0-125	0	ST ation N umber representing the Controller on the fieldbus.

Terminal Description, Base part (Continued)

Terminal Name	Allowed Values	Recommended Value	Description
TIMESYNC	0	0	Send a TIME SYN chronization message. <i>Not supported yet.</i>
SYNCCYCL		100	SYN chronization CYCL e for time synchronization message. <i>Not supported yet.</i>
CABLE		S	CABLE connection. S=Single, R=Redundant. <i>Not supported yet.</i>
ERR		0	ERR or flag indicating hardware or configuration error.
DIAG		0	DIAG nostic flag for PROFIBUS-DP station.

(1) BUS number 0 cannot be used in conjunction with STATION number 0.

Bus parameters

Edit DB Terminal Values - PB1

PROFIBUS-DP : ▼

500	BAUDRATE
0	ECL2SERV
2000	DCNTRTIM
1	CLEAR
200	SLOTTIME
11	MINTSDR
100	MAXTSDR
0	QUIETTIM
1	SETTIME
10	GAPFACTOR
125	HSA
1	MAXRETRY

Terminal Description, Bus parameters

Terminal Name	Allowed Values	Recommended Value	Description
BAUDRATE	9.6, 19.2, 93.75, 187.5, 500, 1.5M, 3M, 6M, 12M	500	BAUDRATE of PROFIBUS network in kilobytes per second (kbps). When this value is changed, the related timing parameters (see below) are automatically changed to the standard values as specified by EN 50170.
ECL2SERV	1, 0	0	1 = Enable C lass 2 S ERVER access, 0 = disable class 2 server access. Allows a PROFIBUS-DP master class 2 to access the class 1 master in the PM634 with PROFIBUS-DP interface.

Terminal Description, Bus parameters (Continued)

Terminal Name	Allowed Values	Recommended Value	Description
DCNTRTIM	0–65535	2000	Data CoNTRol TIME in milliseconds. Time-out supervision of master-slave dialog. Must be at least $6 \times T_{WD}$
CLEAR	0, 1	1	If data exchange fails, all outputs of PROFIBUS-DP slaves are set to 0 (CLEAR). <i>Not supported yet.</i>
SLOTTIME	0–65535	200	SLOTTIME T_{SL} . The maximum time a PROFIBUS-DP master must wait for a transaction response. Given in t_{BIT}
MINTSDR	0–65535	11	MIN T_{SDR} . Minimum PROFIBUS-DP slave delay. Given in t_{BIT}
MAXTS DR	0–65535	100	MAX T_{SDR} . Maximum PROFIBUS-DP slave delay. Given in t_{BIT}
QUIETTIM	0–255	0	QUIETTIME T_{QUI} . Transmitter fall time. Given in t_{BIT}
SETTIME	0–255	1	SETup TIME T_{SET} . Time between event and reaction. Given in t_{BIT}
GAPFACTR	0–100	10	GAP FACToR . Number of token rounds between GAP maintenance cycles.
HSA	2–126	125	Highest Station (slave) Address configured on this bus.
MAXRETRY	1–8	1	MAXimum number of times to RETRY transmission.

The value of the following terminals changes to the specified default if terminal BAUDRATE is changed:

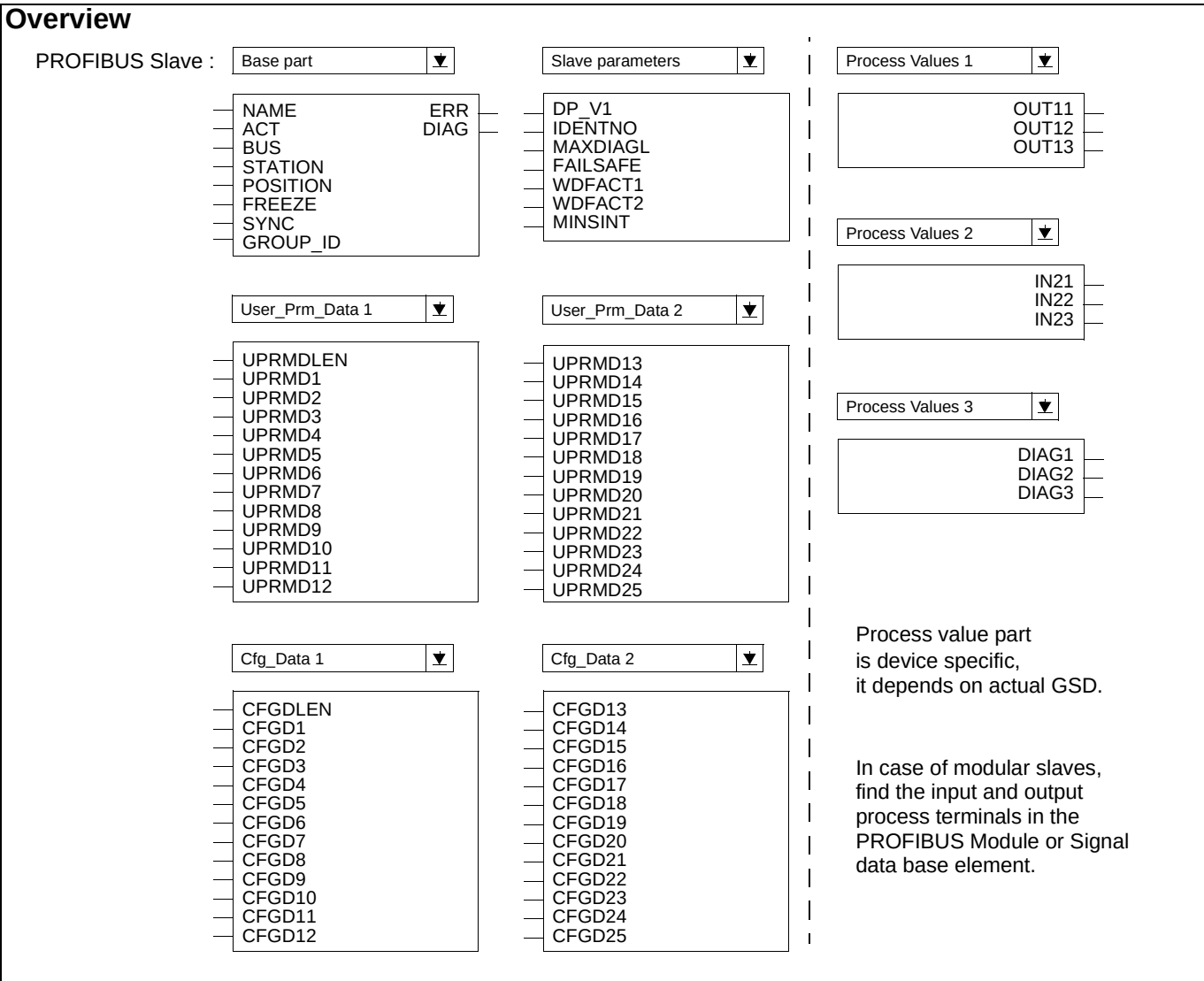
Defaults depending on BAUDRATE

BAUDRATE	SLOTTIME	MAXTS DR	QUIETTIM	SETTIME	MAXRETRY
9.6	100	60	0	1	1
19.2	100	60	0	1	1
93.75	100	60	0	1	1
187.5	100	60	0	1	1
500	200	100	0	1	1
1.5M	300	150	0	1	1
3M	400	250	3	4	2
6M	600	450	6	8	3
12M	1000	800	9	16	4

3.7.2 Data Base Element PROFIBUS-DP Slave, Standard Part

Summary

PROFIBUS Slave data base elements specify the interface to PROFIBUS-DP. The name of PROFIBUS Slave data base element types is taken from their GSD. It can also be renamed by the PROFIBUS Library Editor. The elements contain configuration as well as diagnostic information. Every compact slave device is mapped to a specific PROFIBUS Slave data base element. Every modular slave device is mapped to a specific PROFIBUS Slave data base element and a set of specific PROFIBUS Module and most cases also to a set of PROFIBUS Signal elements. See also [Section 3.7.4, Data Base Element PROFIBUS-DP Module](#) and [Section 3.7.5, DB Element for PROFIBUS-DP Signal](#). All PROFIBUS Slave data base elements have some common parts which contain configuration data, diagnostic information. These parts are described here. The layout of the process value part depends on the GSD of a PROFIBUS-DP slave and is not part of this template.



Base part

Edit DB Terminal Values - PBS1

PROFIBUS-DP Slave : Base part

PBS1

NAME	ERR
1	DIAG
0	
1	
0	
0	
0	
0	
0	

Terminal Description, Base part

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
NAME	user	PBx	–	Unique NAME of the slave.	Max. 20 characters.
ACT	user	1	–	Element is: 0=spare 1= ACT ive	–
BUS	user	–	–	Unique BUS number of the PROFIBUS-DP.	Range 0 to 255 ⁽¹⁾ .
STATION	user	1	–	STATION number representing the Slave on the fieldbus.	Range 0 to 125.
POSITION	predef	0	–	POSITION number 0 representing the Slave on the fieldbus.	–
FREEZE	predef	0	B(r/w)	FREEZE PROFIBUS-DP slave.	Not supported in this version.
SYNC	predef	0	B(r/w)	SYN chronize PROFIBUS-DP slave.	Not supported in this version.
GROUP_ID	predef	0	–	GROUP ID of PROFIBUS-DP slave.	GROUP ID for the FREEZE and SYNC functions. Not supported in this version.
ERR	system	0	B(r)	ERR or flag indicating hardware or configuration error.	–
DIAG	system	0	B(r)	DIAG nostic flag for PROFIBUS-DP station.	–

(1) BUS number 0 cannot be used in conjunction with STATION number 0.

Slave parameters

The screenshot shows a software window titled "Edit DB Terminal Values - PBS1". Inside, there is a section for "PROFIBUS-DP Slave" with a dropdown menu set to "Slave parameters". Below this, a list of parameters is shown with their values:

- 0 — DP_V1
- H'0000 — IDENTNO
- 32 — MAXDIAGL
- 1 — FAILSAFE
- 0 — WDFACT1
- 0 — WDFACT2
- 0 — MINSINT

Terminal Description, Slave parameters

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
DP_V1	GSD/user	0	—	PROFIBUS-DP slave uses DPV1 (earlier DP/E) functionality: 0=DP-slave functionality of EN50170 1=DP-slave with DP/V1functionality.	GSD keyword: DPV1_slave . This goes to the sIFlag configuration parameter, bit 2–4.
IDENTNO	GSD/user	H'0000	—	Unique PROFIBUS-DP device IDENT ifier. Assigned by PNO.	H'0000 to H'FFFF. GSD keyword: Ident_Number .
MAXDIAGL	GSD/user	32	—	MAX imum DIAG nostic data L ength.	Range 6 to 236. GSD keyword: Max_Diag_Data_Len .
FAILSAFE	GSD/user	0	—	FAILSAFE capability: 0= The master sends output data with zero length 1= The master sends output data with all outputs set to zero	GSD keyword: Fail_Safe .
WDFACT1	user	0	—	Watch Dog FACT or 1.	Range 0 to 255. After expiration of timer the slave sets outputs to 0. ⁽¹⁾
WDFACT2	user	0	—	Watch Dog FACT or 2.	
MINSINT	GSD/user	0	—	MINimum Slave INT erval. Minimum time between two poll cycles (0–65535 × 0.1ms).	Range 0 to 65535 ⁽²⁾ . GSD keyword: Min_Slave_Interval

(1) Slave supervision of connection with time out $T_{WD} = WDFACT1 \times WDFACT2 \times 10ms$. No supervision if $WDFACT1 = WDFACT2 = 0$.

(2) If baud rate 12 Megabaud is used, values > 178 are avoided.

User_Prm_Data 1

— Edit DB Terminal Values - PBS1

PROFIBUS-DP Slave : User_Prm_Data 1 ▼

0 — UPRMDLEN
— UPRMD1
— UPRMD2
— UPRMD3
— UPRMD4
— UPRMD5
— UPRMD6
— UPRMD7
— UPRMD8
— UPRMD9
— UPRMD10
— UPRMD11
— UPRMD12

Terminal Description, User_Prm_Data 1

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
UPRMDLEN	GSD/user	0	—	User PaRaMeter Data LENgth.	Range 0 to 217 ⁽¹⁾ . GSD keyword: User_Prm_Data_Len.
UPRMD1	GSD/user		—	User PaRaMeter Data, 1st 10 bytes.	20 character string representing a hexadecimal number. GSD keyword: User_Prm_Data.
UPRMD2	GSD/user		—	User PaRaMeter Data, 2nd 10 bytes.	
:	:	:	:	:	
UPRMD12	GSD/user		—	User PaRaMeter Data, 12th 10 bytes.	

- (1) $UPRMDLEN + CFGDLEN \leq 217$.
Number of bytes given in UPRMDLEN must match the number of bytes specified in UPRMD1, UPRMD2, ...
Terminals with unused bytes (value empty or blank) are allowed.

User_Prm_Data 2

Edit DB Terminal Values - PBS1

PROFIBUS-DP Slave :

User_Prm_Data 2

UPRMD13

UPRMD14

UPRMD15

UPRMD16

UPRMD17

UPRMD18

UPRMD19

UPRMD20

UPRMD21

UPRMD22

UPRMD23

UPRMD24

UPRMD25

Terminal Description, User_Prm_Data 2

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
UPRMD13 ⁽¹⁾	GSD/user		—	User PaRaMeter Data, 13th 10 bytes.	20 character string representing a hexadecimal number. GSD keyword: User_Prm_Data.
UPRMD14	GSD/user		—	User PaRaMeter Data, 14th 10 bytes.	
:	:	:	:	:	
UPRMD25	GSD/user		—	User PaRaMeter Data, 25th 10 bytes.	

(1) Section User_Prm_Data 2 can be missing depending on UPRMDLEN.

Cfg_Data 1

—
Edit DB Terminal Values - PBS1

PROFIBUS-DP Slave : Cfg_Data 1 ▼

0 —

CFGDLEN
CFGD1
CFGD2
CFGD3
CFGD4
CFGD5
CFGD6
CFGD7
CFGD8
CFGD9
CFGD10
CFGD11
CFGD12

Terminal Description, Cfg_Data 1

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
CFGDLEN	GSD/user	0	—	ConFiG Data LENgth . Must be calculated from the actual configuration.	Range 0 to 217 ⁽¹⁾ . GSD keyword: Module . (Can be several for modular devices.)
CFGD1	GSD/user		—	ConFiGuration Data, 1st 10 bytes .	20 character string representing a hexadecimal number. GSD keyword: Module .
CFGD2	GSD/user		—	ConFiGuration Data, 2nd 10 bytes .	
:	:	:	:	:	
CFGD12	GSD/user		—	ConFiGuration Data, 12th 10 bytes .	

- (1) $UPRMDLEN + CFGDLEN \leq 217$.
Number of bytes given in CFGDLEN must match the number of bytes specified in CFGD1, CFGD2, ...
Terminals with unused bytes (value empty or blank) are allowed.

Cfg_Data 2

Edit DB Terminal Values - PBS1

PROFIBUS-DP Slave :

Cfg_Data 2

—

CFGD13

—

CFGD14

—

CFGD15

—

CFGD16

—

CFGD17

—

CFGD18

—

CFGD19

—

CFGD20

—

CFGD21

—

CFGD22

—

CFGD23

—

CFGD24

—

CFGD25

Terminal Description, Cfg_Data 2

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
CFGD13 ⁽¹⁾	GSD/user		—	ConFiGuration Data, 13th 10 bytes.	20 character string representing a hexadecimal number. GSD keyword: Module.
CFGD14	GSD/user		—	ConFiGuration Data, 14th 10 bytes.	
:	:	:	:	:	
CFGD25	GSD/user		—	ConFiGuration Data, 25th 10 bytes.	

(1) Section Cfg_Data 2 can be missing depending on CFGDLEN.

In case of modular slaves, the CFG data from the GSD file are added not to the PROFIBUS Slave data base type but to its Module data base types.

3.7.3 Data Base Element PROFIBUS-DP Slave, Process Data Part

There is no PROFIBUS-DP slave DB element delivered with ACC. Instead, you create these elements yourself according to the specific devices used in your application.

ACC contains a program, the PROFIBUS Library Editor, that is designed to help you create specific DB elements. See *PROFIBUS Library Editor User's Guide*.

The PROFIBUS Library Editor always creates the standard element windows as described previously and allows you to define the process data part based on the PROFIBUS-DP device's specifications.

It is possible to allocate an input or output terminal at the DB element for each value within the PROFIBUS-DP PDU (Protocol Data Unit, the PROFIBUS telegram). You can view the PROFIBUS-DP PDU for any given slave as being divided in three parts: input data, output data and diagnostic data. Each of the three DPU parts contains up to 244¹ process values or diagnostic data in PROFIBUS-DP data types.

In fact, this is the way the PROFIBUS-DP interface provides the data to the system CPU.

Figure 3-31 illustrates this memory layout.

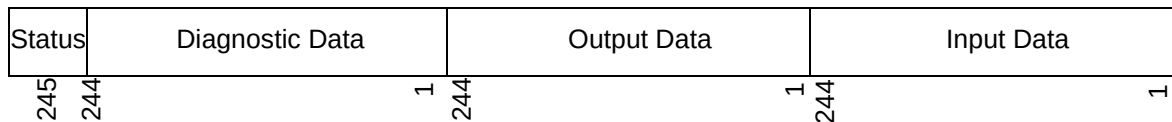


Figure 3-31. CPU View of Process and Diagnostic Data for Any Given Slave

Data consistency

PROFIBUS-DP and PROFIBUS-DPV1 allows the declaration of consistency data type blocks. The PROFIBUS-DP interface guarantees data consistency only over a singular data type within such a block.

Inputs and Outputs

By the PROFIBUS Library Editor you can specify up to 8 process value windows to display the process values and diagnostic data. Each window can contain up to 18 process values and/or diagnostic data identified by their position. The default names of these windows are "Process Values x", where x=1, 2,... 8.

In PROFIBUS Library Editor you specify the position of process values and diagnostic data and their data type. Each position must be included exactly once in any of the windows.

With this specification the PM634 with PROFIBUS-DP interface is able to determine where the value is located in the PROFIBUS-DP DPU. The data is mapped to a AMPL data type according to the specified data type conversion.

1. For diagnostic data only slaves with a amount of up to 236 diagnostics bytes are supported.

The supported data types change with the protocol variant of PROFIBUS-DP:

- The classic PROFIBUS-DP only knows about byte (unsigned8) and word (unsigned16) values. You have to convert these raw formats into data types that suit the physical value, using PC elements.
- PROFIBUS-DPV1 recognizes a large number of different data formats automatically. [Table 3-2](#) and [Table 3-3](#) show the relation between the various PROFIBUS-DPV1 and AMPL data types. You specify by the PROFIBUS Library Editor one of the variants. The default mapping at interpretation of manufacturer-specific CFG data bytes in *GSD file is shown in *PROFIBUS Library Editor User's Guide*, Appendix B.

Table 3-2. PROFIBUS-DPV1 Versus AMPL Data Types

PROFIBUS-DPV1		AMPL Data Type	Remarks
Data Type	Number of Bytes		
Boolean	1	B	—
Integer8	1	I, IL, B	—
Integer16	2	I, IL, B	—
Integer32	4	IL, B	—
Unsigned8	1	I, IL, B	Transmitted as a byte in DP
Unsigned16	2	IL, B	Transmitted as two bytes in DP
Unsigned32	4	IL, B	When the range is exceeded the output is set to the maximum Integer Long value.
Floating Point	4	R	—
Visible String	1, 2, 3, ...	I, IL, B	1
Octet String	1, 2, 3, ...	I, IL, B	1
Date	7	—	Not supported ²
Time Of Day	4 or 6	—	Not supported ²
Time Difference	4 or 6	—	Not supported ²

1 Each byte is mapped separately.

2 Only PROFIBUS-DP devices without the default data types (code 11 to 15) can be processed.
For PROFIBUS-DP slaves with these data types raw value handling is done (each byte of the complete PROFIBUS PDU is mapped separately).

Table 3-3. AMPL Versus PROFIBUS-DPV1 Data Types

AMPL Data Type	PROFIBUS-DPV1		Remarks
	Data Type	Number of Bytes	
B	Boolean	1	–
I, IL, B	Integer8	1	Only the lower 8 bits of I, IL are used.
I, IL, B	Integer16	2	Only the lower 16 bits of I are used.
IL, B	Integer32	4	–
I, IL, B	Unsigned8	1	Only the lower 8 bits of I, IL are used.
I, IL, B	Unsigned16	2	Only the lower 16 bits of I are used.
IL, B	Unsigned32	4	–
R	Floating Point	4	–
I, IL, B	Visible String	1, 2, 3, ...	Only the lower 8 bits of I, IL are used. ¹
I, IL, B	Octet String	1, 2, 3, ...	Only the lower 8 bits of I, IL are used. ¹
–	Date	7	Not supported. ²
–	Time Of Day	4 or 6	Not supported. ²
–	Time Difference	4 or 6	Not supported. ²

- 1 Each byte is mapped separately.
- 2 Only PROFIBUS-DP devices without the default data types (code 11 to 15) can be processed.
For PROFIBUS-DP slaves with these data types raw value handling is done (each byte of the complete PROFIBUS PDU is mapped separately).

Diagnostics

The Diagnostics Data area holds the bytes that the PROFIBUS-DP devices deliver in the diagnostics part of the PDU (Protocol Data Unit, the PROFIBUS telegram). You should enter the maximum value of 236 at the MAXDIAGL terminal if the actual value for the device is not given in the GSD file.

The contents of these status bytes are completely defined by the device's manufacturer and can be found in the relevant documentation.

The status byte at position 245 in the Diagnostics Data area delivers information about how the PROFIBUS-DP master views the slave device. [Table 3-4](#) shows the bit definitions in this byte.

NOTE

The PROFIBUS-DP interface cannot handle slaves with more than 236 diagnostic data bytes.

Table 3-4. Slave Status As Seen by Master

Bit	Description
0–3	Device connection status: 0 – connection up and running 1 – error in establishing connection 3 – slave activated 4 – slave deactivated 5 – slave not configured
4	Not used.
5	Slave parameter fault flag: PDU size mismatch, e.g., the maximum diagnostic data length value is too low.
6	Data transfer flag: set when the slave is in the Data Exchange Mode. This means that the communication is up and running.
7	System diagnostic flag: set when new diagnostic information is available at the slave.

3.7.4 Data Base Element PROFIBUS-DP Module

Summary

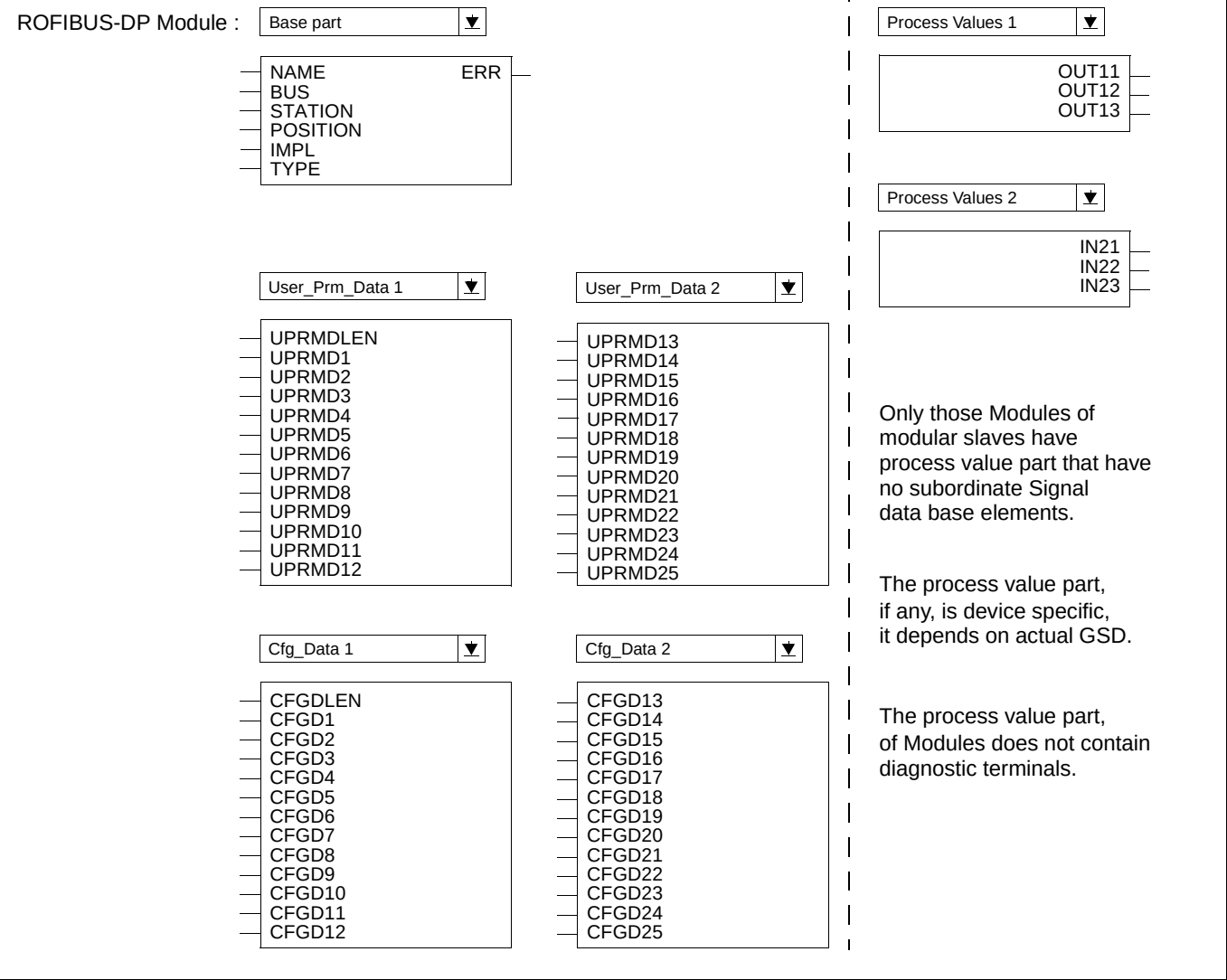
Every modular slave device is mapped to a specific PROFIBUS Slave data base element and a set of specific PROFIBUS Module and in most cases also to a set of PROFIBUS Signal elements.

All PROFIBUS Module data base elements have some common parts which contain configuration data. These parts are described here.

The name of PROFIBUS Module data base element types is taken from the GSD of the parent modular Slave. The name of the Module data base element type can also be renamed by the PROFIBUS Library Editor.

The module data base elements having subordinate Signal elements have no process value part. The module data base elements having no subordinate Signal elements have process value part. The layout of the process value part, if there is any, depends on the GSD of the parent PROFIBUS-DP modular slave.

Overview



Base part

Edit DB Terminal Values - PBS1

PROFIBUS-DP Module :

Base part

PBS1

1

1

1

1

ABC123

NAME

BUS

STATION

POSITION

IMPL

TYPE

ERR

Terminal Description, Base part

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
NAME	user	PBx	—	Unique NAME of the Module.	Max. 20 characters.
BUS	user	—	—	Unique BUS number of the PROFIBUS-DP.	Range 0 to 255 ⁽¹⁾ .
STATION	user	1	—	STATION number representing the modular Slave on the fieldbus.	Range 0 to 125.
POSITION	predef	0	—	POSITION number representing the Module on the fieldbus.	—
IMPL	user	1	—	IMPL emented. 0 = the Module is spare 1 = the Module is implemented.	—
TYPE	predef	—	B(r)	Module TYPE .	—

(1) BUS number 0 cannot be used in conjunction with STATION number 0.

User_Prm_Data 1

— Edit DB Terminal Values - PBS1

PROFIBUS-DP Module : User_Prm_Data 1 ▼

0 — UPRMDLEN
— UPRMD1
— UPRMD2
— UPRMD3
— UPRMD4
— UPRMD5
— UPRMD6
— UPRMD7
— UPRMD8
— UPRMD9
— UPRMD10
— UPRMD11
— UPRMD12

Terminal Description, User_Prm_Data 1

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
UPRMDLEN	GSD/user	0	—	User PaRaMeter Data LENgth.	Range 0 to 217 ⁽¹⁾ . GSD keyword: User_Prm_Data_Len.
UPRMD1	GSD/user		—	User PaRaMeter Data, 1st 10 bytes.	20 character string representing a hexadecimal number. GSD keyword: User_Prm_Data.
UPRMD2	GSD/user		—	User PaRaMeter Data, 2nd 10 bytes.	
:	:	:	:	:	
UPRMD12	GSD/user		—	User PaRaMeter Data, 12th 10 bytes.	

- (1) $UPRMDLEN + CFGDLEN \leq 217$.
Number of bytes given in UPRMDLEN must match the number of bytes specified in UPRMD1, UPRMD2, ...
Terminals with unused bytes (value empty or blank) are allowed.

User_Prm_Data 2

Edit DB Terminal Values - PBS1

PROFIBUS-DP Module :

User_Prm_Data 2

UPRMD13

UPRMD14

UPRMD15

UPRMD16

UPRMD17

UPRMD18

UPRMD19

UPRMD20

UPRMD21

UPRMD22

UPRMD23

UPRMD24

UPRMD25

Terminal Description, User_Prm_Data 2

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
UPRMD13 ⁽¹⁾	GSD/user		—	User PaRaMeter Data, 13th 10 bytes.	20 character string representing a hexadecimal number. GSD keyword: User_Prm_Data.
UPRMD14	GSD/user		—	User PaRaMeter Data, 14th 10 bytes.	
:	:	:	:	:	
UPRMD25	GSD/user		—	User PaRaMeter Data, 25th 10 bytes.	

(1) Section User_Prm_Data 2 can be missing depending on UPRMDLEN.

In case of modular slaves, the CFG data from the GSD file are added to the PROFIBUS Module data base types and not to the parent Slave data base type:

Cfg_Data 1

Edit DB Terminal Values - PBS1

PROFIBUS-DP Module :

Cfg_Data 1

▼

0

CFGDLEN

CFGD1

CFGD2

CFGD3

CFGD4

CFGD5

CFGD6

CFGD7

CFGD8

CFGD9

CFGD10

CFGD11

CFGD12

Terminal Description, Cfg_Data 1

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
CFGDLEN	GSD/user	0	—	ConFiG Data LENgth . Must be calculated from the actual configuration.	Range 0 to 217 ⁽¹⁾ . GSD keyword: Modu l e . (Can be several for modular devices.)
CFGD1	GSD/user		—	ConFiGuration Data, 1st 10 bytes.	20 character string representing a hexadecimal number. GSD keyword: Modu l e .
CFGD2	GSD/user		—	ConFiGuration Data, 2nd 10 bytes.	
:	:	:	:	:	
CFGD12	GSD/user		—	ConFiGuration Data, 12th 10 bytes.	

(1) $UPRMDLEN + CFGDLEN \leq 217$.
 Number of bytes given in CFGDLEN must match the number of bytes specified in CFGD1, CFGD2, ...
 Terminals with unused bytes (value empty or blank) are allowed.

Cfg_Data 2

—

Edit DB Terminal Values - PBS1

PROFIBUS-DP Module :

Cfg_Data 2

▼

—

CFGD13

—

CFGD14

—

CFGD15

—

CFGD16

—

CFGD17

—

CFGD18

—

CFGD19

—

CFGD20

—

CFGD21

—

CFGD22

—

CFGD23

—

CFGD24

—

CFGD25

Terminal Description, Cfg_Data 2

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
CFGD13 ⁽¹⁾	GSD/user		—	ConFiGuration Data, 13th 10 bytes.	20 character string representing a hexadecimal number. GSD keyword: Module.
CFGD14	GSD/user		—	ConFiGuration Data, 14th 10 bytes.	
:	:	:	:	:	
CFGD25	GSD/user		—	ConFiGuration Data, 25th 10 bytes.	

(1) Section Cfg_Data 2 can be missing depending on CFGDLEN.

Only Modules not having subordinated Signals have process data. The Process Values part of the Module depends on the GSD file of the parent modular slave. For process value terminals see [Section 3.7.3, Data Base Element PROFIBUS-DP Slave, Process Data Part](#).

3.7.5 DB Element for PROFIBUS-DP Signal

Summary

Every modular slave device is mapped to a specific PROFIBUS Slave data base element and a set of specific PROFIBUS Module and for each Module—if the Module has no process terminals—also to a PROFIBUS Signal element.

All PROFIBUS Signal data base elements have some common parts which contain configuration data. These parts are described here.

The name of PROFIBUS Signal data base element types is taken from the GSD of the parent modular Slave; it is the name of the parent Module and an 'S' appended. The name of the Signal data base element type can also be renamed by the PROFIBUS Library Editor.

The layout of the process value part of the Signal element depends on the GSD of the parent PROFIBUS-DP modular slave.

Overview

PROFIBUS Signal :

Base part

NAME

SW_REF

ACT

ERR

User_Prm_Data 1

User_Prm_Data 2

UPRMDLEN

UPRMD1

UPRMD2

UPRMD3

UPRMD4

UPRMD5

UPRMD6

UPRMD7

UPRMD8

UPRMD9

UPRMD10

UPRMD11

UPRMD12

UPRMD13

UPRMD14

UPRMD15

UPRMD16

UPRMD17

UPRMD18

UPRMD19

UPRMD20

UPRMD21

UPRMD22

UPRMD23

UPRMD24

UPRMD25

Cfg_Data 1

Cfg_Data 2

CFGDLEN

CFGD1

CFGD2

CFGD3

CFGD4

CFGD5

CFGD6

CFGD7

CFGD8

CFGD9

CFGD10

CFGD11

CFGD12

CFGD13

CFGD14

CFGD15

CFGD16

CFGD17

CFGD18

CFGD19

CFGD20

CFGD21

CFGD22

CFGD23

CFGD24

CFGD25

Process Values

VALUE

The process value part is device specific, it depends on actual GSD.

The process value part, of Signals does not contain diagnostic terminals.

Base part

Edit DB Terminal Values - PBS1

PROFIBUS-DP Signal :

Base part

PBS1

NAME

SW_REF

1

ACT

ERR

Terminal Description, Base part

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
NAME	user	PBx	–	Unique NAME of the Signal.	Max. 20 characters.
SW_REF	system	–	–	Backward reference to an extended DB element.	Range 0 to255.
ACT	user	1	–	Element is: 0 = spare 1 = ACT ive	–

User_Prm_Data 1

— Edit DB Terminal Values - PBS1

PROFIBUS-DP Signal : User_Prm_Data 1 ▼

0 — UPRMDLEN
— UPRMD1
— UPRMD2
— UPRMD3
— UPRMD4
— UPRMD5
— UPRMD6
— UPRMD7
— UPRMD8
— UPRMD9
— UPRMD10
— UPRMD11
— UPRMD12

Terminal Description, User_Prm_Data 1

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
UPRMDLEN	GSD/user	0	—	User PaRaMeter Data LENgth.	Range 0 to 217 ⁽¹⁾ . GSD keyword: User_Prm_Data_Len.
UPRMD1	GSD/user		—	User PaRaMeter Data, 1st 10 bytes.	20 character string representing a hexadecimal number. GSD keyword: User_Prm_Data.
UPRMD2	GSD/user		—	User PaRaMeter Data, 2nd 10 bytes.	
:	:	:	:	:	
UPRMD12	GSD/user		—	User PaRaMeter Data, 12th 10 bytes.	

- (1) $UPRMDLEN + CFGDLEN \leq 217$.
Number of bytes given in UPRMDLEN must match the number of bytes specified in UPRMD1, UPRMD2, ...
Terminals with unused bytes (value empty or blank) are allowed.

User_Prm_Data 2

Edit DB Terminal Values - PBS1

PROFIBUS-DP Signal :

User_Prm_Data 2

UPRMD13

UPRMD14

UPRMD15

UPRMD16

UPRMD17

UPRMD18

UPRMD19

UPRMD20

UPRMD21

UPRMD22

UPRMD23

UPRMD24

UPRMD25

Terminal Description, User_Prm_Data 2

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
UPRMD13 ⁽¹⁾	GSD/user		–	User PaRaMeter Data, 13th 10 bytes.	20 character string representing a hexadecimal number. GSD keyword: User_Prm_Data.
UPRMD14	GSD/user		–	User PaRaMeter Data, 14th 10 bytes.	
:	:	:	:	:	
UPRMD25	GSD/user		–	User PaRaMeter Data, 25th 10 bytes.	

(1) Section User_Prm_Data 2 can be missing depending on UPRMDLEN.

Cfg_Data 1

— Edit DB Terminal Values - PBS1

PROFIBUS-DP Signal : Cfg_Data 1 ▼

0 — CFGDLEN
— CFGD1
— CFGD2
— CFGD3
— CFGD4
— CFGD5
— CFGD6
— CFGD7
— CFGD8
— CFGD9
— CFGD10
— CFGD11
— CFGD12

Terminal Description, Cfg_Data 1

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
CFGDLEN	GSD/user	0	—	ConFIG Data LENgth . Must be calculated from the actual configuration.	Range 0 to 217 ⁽¹⁾ . GSD keyword: Module. (Can be several for modular devices.)
CFGD1	GSD/user		—	ConFiGuration Data, 1st 10 bytes.	20 character string representing a hexadecimal number. GSD keyword: Module.
CFGD2	GSD/user		—	ConFiGuration Data, 2nd 10 bytes.	
:	:	:	:	:	
CFGD12	GSD/user		—	ConFiGuration Data, 12th 10 bytes.	

- (1) $UPRMDLEN + CFGDLEN \leq 217$.
Number of bytes given in CFGDLEN must match the number of bytes specified in CFGD1, CFGD2, ...
Terminals with unused bytes (value empty or blank) are allowed.

Cfg_Data 2

—

Edit DB Terminal Values - PBS1

PROFIBUS-DP Signal :

Cfg_Data 2 ▾

—

CFGD13

—

CFGD14

—

CFGD15

—

CFGD16

—

CFGD17

—

CFGD18

—

CFGD19

—

CFGD20

—

CFGD21

—

CFGD22

—

CFGD23

—

CFGD24

—

CFGD25

Terminal Description, Cfg_Data 2

Terminal Name	Value entered by	Default value	PC connection data type	Description	Remarks
CFGD13 ⁽¹⁾	GSD/user		—	ConFiGuration Data, 13th 10 bytes.	20 character string representing a hexadecimal number. GSD keyword: Module.
CFGD14	GSD/user		—	ConFiGuration Data, 14th 10 bytes.	
:	:	:	:	:	
CFGD25	GSD/user		—	ConFiGuration Data, 25th 10 bytes.	

(1) Section Cfg_Data 2 can be missing depending on CFGDLEN.

The Process Values part of the Signal depends on the GSD file of the parent modular slave.
For process value terminals see [Section 3.7.3, Data Base Element PROFIBUS-DP Slave, Process Data Part](#).

3.7.6 Contents of a GSD File

The GSD file contains information about the PROFIBUS-DP slaves. Its contents are defined in EN 50170.

There is a GSD file for each PROFIBUS-DP slave, provided by the manufacturer of the device. It describes the capabilities of a certain slave, such as supported baud rates and/or other functions. Furthermore, you find configuration data in the GSD file. These configuration data is used by the PROFIBUS-DP master to check whether your configuration matches the actually connected slave.

The GSD file has the following general format:

KEYWORD = *value*

where: *KEYWORD* is a keyword defined in the PROFIBUS-DP norm;
value is either a string or a number (in decimal or hexadecimal notation).

The [Table 3-5](#) shows the most important keywords which are used to find data to create and configure PROFIBUS-DP slave DB elements in Advant Controller 110/160.

Table 3-5. GSD Keywords

GSD Keyword	Description	Use at DB Element / Remark
Baud_supp	Describes the baud rates the slave can handle. <i>Baud</i> might have a range of 9.6–12M	PB:BAUDRATE Note: that all connected slaves must support the specified baud rate
MaxTsdr_Baud	Specifies the maximum time that a slave needs to respond. <i>Baud</i> might have a range of 9.6–12M Given in T _{BIT}	PB:MAXTSRDR
MinTsdr_Baud	Specifies the minimum time that a slave needs to respond. <i>Baud</i> might have a range of 9.6–12M Given in T _{BIT}	PB:MINTSRDR
Ident_Number	This is the ident number of the slave	PBS:IDENTNO
Freeze_Mode_supp	The slave is able to handle the freeze mode. 1 = freeze mode supported 0 = not supported	PBS:FREEZE
Sync_Mode_supp	The slave is able to handle the sync mode. 1 = sync mode supported 0 = not supported	PBS:SYNC
User_Prm_Data_Len	This figure gives the maximum length of the user parameter data	PBS:UPRMDLEN

Table 3-5. GSD Keywords

GSD Keyword	Description	Use at DB Element / Remark
User_Prm_Data	Vendor specific data for the slave. Its length must match User_Prm_Data_Len	PBS:UPRMD1 to UPRMD25
Min_Slave_Interval	Minimum time between two accesses to the slave. Given in units of 100 µs.	PBS:MINSINT
Module	see Modular Slaves below	–
Config	see Modular Slaves below	–
Fail_Safe	Specifies whether the slave can accept a data telegram with no data bytes when the master is in the CLEAR ⁽¹⁾ state	PBS:FAILSAFE
Max_Diag_Data_Len	Maximum length of the slave's diagnostic data	PBS:MAXDIAGL Note: this is not a mandatory keyword in EN 50170. If the given figure is too small, the slave will not go to the active state. Specifying an arbitrary large number is allowed.

(1) The master is in the CLEAR state when the AC 110 station is blocked. No data transfer takes place in this state.

For mapping of further keywords see *PROFIBUS Library Editor User's Guide*, Appendix B.

Modular Slaves

Modular slaves need configuration data that is specific for each module. The slave vendor's GSD file contains a description of the configuration data for all supported modules.

The configuration data for any give module is defined between the keywords `Module` and `EndModule` in the GSD file.

The configuration data for the complete slave is generated by appending the configuration data for each module to the CFGD* terminals of the slave DB element.

Most manufacturers deliver a very large GSD description that describes all the available modules in one single file. This makes it some times difficult to find the data for a given module of a modular slave.

3.8 Performance

This section briefly describes the performance of the PROFIBUS interface of PM634 and PM644. The section contains calculation formulas and tables.

Approximate calculation¹ of required time for one bus cycle T_{BC} :

Formulas:

$$\begin{aligned} T_{MC} &= T_{S/R} + T_{SDR} \times T_{BIT} + T_{A/R} + T_{ID} \times T_{BIT} + T_{EXE} \times (N_I + N_O) \\ T_{S/R} &= (N_{HD} + N_I) \times N_{BB} \times T_{BIT} \\ T_{A/R} &= (N_{HD} + N_O) \times N_{BB} \times T_{BIT} \\ N_{IOA} &= \sum (N_I + N_O) / N_{slave} \\ T_{BC} &= T_{PRT} + \sum T_{MC} \end{aligned}$$

$$T_{BC} = 10 \text{ ms} + [(198 + 2 \times MAX T_{SDR} + 11 \times N_{IOA}) T_{BIT} + 0.0072 \text{ ms} \times N_{IOA}] N_{slave}$$

Definitions:

N_{HD}	=	9 byte
N_{BB}	=	11 bit/byte
T_{EXE}	=	0.0072 ms
T_{PRT}	=	10 ms
T_{SDR}	=	MAX T_{SDR} ²
T_{ID}	=	MAX T_{SDR}

Abbreviations:

T_{BC}	=	Bus Cycle time PROFIBUS in ms
T_{MC}	=	Message Cycle time PROFIBUS per slave in ms
T_{PRT}	=	Program Run Time PROFIBUS interface in ms
T_{EXE}	=	Execution time data conversion PROFIBUS interface for one I/O value in ms
$T_{S/R}$	=	Send/Request frame time in ms
T_{SDR}	=	Actual Station Delay of Responder in T_{BIT}
MAX T_{SDR}	=	Maximum Station Delay of Responder in T_{BIT}
$T_{A/R}$	=	Acknowledgement/Response frame time in ms
T_{ID}	=	Idle time in T_{BIT}
T_{BIT}	=	Bit Time (1/baudrate)
N_{slave}	=	No of slaves
N_{IOA}	=	No of I/O bytes per slave
N_I	=	No of Input bytes per slave
N_O	=	No of Output byte per slave
N_{HD}	=	No of Header bytes per PDU
N_{BB}	=	No of Bits/Byte

Assumptions:

1. Mono master system (with one PM644 or one PM634).
2. All slaves are in data exchange mode, with no diagnostic data pending.
3. All slaves uses standard (no user specific) data types (see [Chapter 3, Configuration/Application Building Figure 3-7](#)).

1. see also EN 50170
2. for worst case calculation

The following figure shows the PROFIBUS configuration used for the performance calculation.

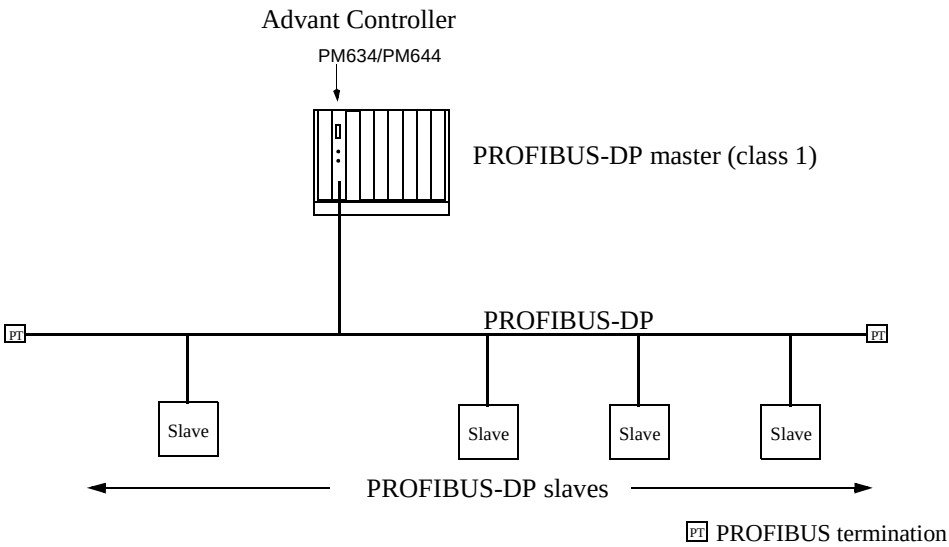


Figure 3-32. PROFIBUS Configuration for Performance Calculation

The following tables shows the different PROFIBUS cycle times depending on the transmission speed:

Table 3-6. PROFIBUS Cycle Time based on Transmission Speed 93.75 kbit/sec

Slaves	PROFIBUS cycle time [ms]			
	input/output bytes per slave			
	2/2 byte	16/16 byte	32/32 byte	244/244 byte
1	14	17	21	74
5	29	47	67	331
10	49	84	124	652
30	127	231	351	1935

Table 3-7. PROFIBUS Cycle Time based on Transmission Speed 187.5 kbit/sec

Slaves	PROFIBUS cycle time [ms]			
	input/output bytes per slave			
	2/2 byte	16/16 byte	32/32 byte	244/244 byte
1	12	14	16	44
5	20	29	40	179
10	30	48	69	348
30	69	124	187	1025

Table 3-8. PROFIBUS Cycle Time based on Transmission Speed 500 kbit/sec

Slaves	PROFIBUS cycle time [ms]			
	input/output bytes per slave			
	2/2 byte	16/16 byte	32/32 byte	244/244 byte
1	11	12	13	25
5	15	19	23	85
10	19	27	37	160
30	37	62	90	461

Table 3-9. PROFIBUS Cycle Time based on Transmission Speed 1500 kbit/sec

Slaves	PROFIBUS cycle time [ms]			
	input/output bytes per slave			
	2/2 byte	16/16 byte	32/32 byte	244/244 byte
1	10	11	11	17
5	12	14	16	47
10	14	18	23	84
30	22	34	48	233

Chapter 4 Runtime Operation

Advant Controller 110 respectively Advant Controller 160 must execute a PC program (mode P1, indicated on the front of the main Processor Module) to communicate on the PROFIBUS link.

When Advant Controller is in STOP mode (mode “P3”, indicated on the diagnostic display on the front of the Processor Module), the communication is stopped as well.

4.1 Operating Overview

After start-up, and with Advant Controller in runtime mode, you can control the following operations:

- The status information for the PROFIBUS link in the PROFIBUS database element can be displayed.
- The status information for the PROFIBUS nodes in the PROFIBUS device database elements can be displayed.

4.2 Runtime Tutorial

A Runtime Tutorial is not included in this manual.

The reader must be familiar with application programming in Advant Controller.

4.3 Operating Instructions

For a description of commands for control of the PC program and Database, please refer to *AMPL Configuration Advant Controller 100 Series Reference Manual*.

4.4 Runtime Operation Menus

Not applicable.

Chapter 5 Maintenance

5.1 Preventive Maintenance

Not applicable.

5.2 Hardware Indicators

Processor Module PM634

Processor Module PM634 has the following indicators on the front panel:

- The green LED is lit when the Processor Module has successfully completed its self-tests.
- The red LED is lit when a hardware error is detected on the Processor Module with PROFIBUS-DP interface module. The LED is shortly switched on and off again during start-up to verify that it is still working.
- The green LED of the PROFIBUS interface is lit when the interface is started from the system CPU and is running correctly.
- The red LED of the PROFIBUS interface is lit when a fatal error is detected either within the interface or at the PROFIBUS line.

Processor Module PM644

Processor Module PM644 has the following indicators on the front panel:

- The green RUN1 LED is lit when Processor Module PM644 has successfully completed its self test and the application program is executed normally.
- The red FAULT LED is lit when a fault condition is detected on Processor Module PM644.
- The green TOKEN LED is lit when the PROFIBUS interface is in possession of the PROFIBUS token.
- The red HALT LED is lit when an halt condition on the processor of the PROFIBUS interface occurred.
- The green R(un) LED is lit when the PROFIBUS interface is configured and operational.
- The red F(ault) LED is lit when the PROFIBUS interface initialization is running or an error occurred.

For a picture and a detailed description of the front panel, see [Appendix A, Processor Module PM634](#), or [Appendix B, Processor Module PM644](#).

5.3 Error Messages

You can access error messages of the Processor Module and the PROFIBUS interface by the Diagnostics program attached to Function Chart Builder.

After having started the Diagnostics program choose the **Target | Report Errors** command.

The reported errors appear in the **Error Report** window. See example in the following figure.

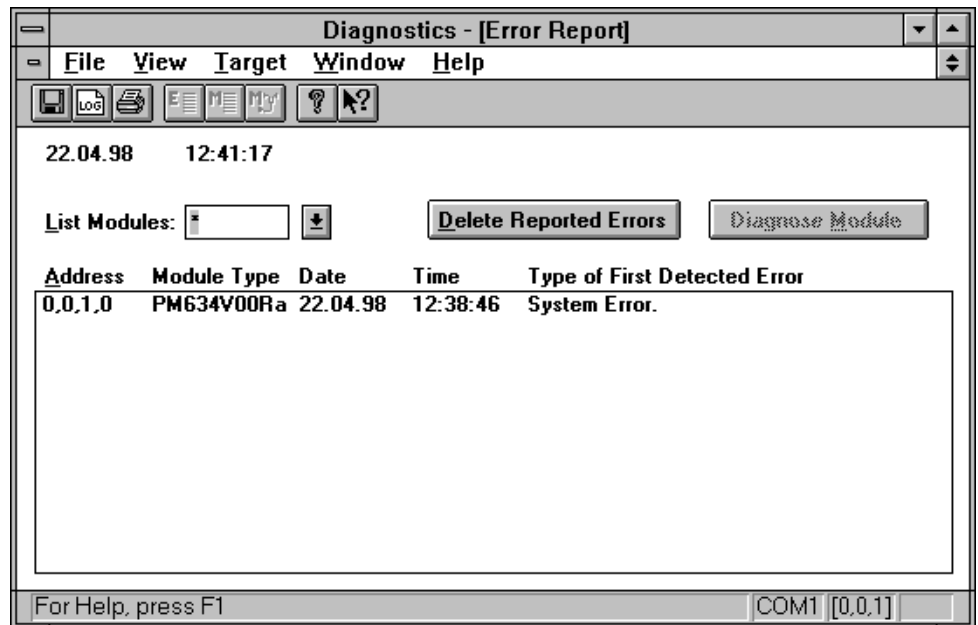


Figure 5-1. Example of Errors in Error Report Window

The line shown in the **Error Report** window says that there is a problem within the Processor Module that is not related to the system software. These “external hardware errors” are indicated for additional hardware subsystems within the Processor Module.

Double-click on that line and the Diagnostics program will show the **Module Diagnostics** window, a detailed list of errors that occurred within the Processor Module.

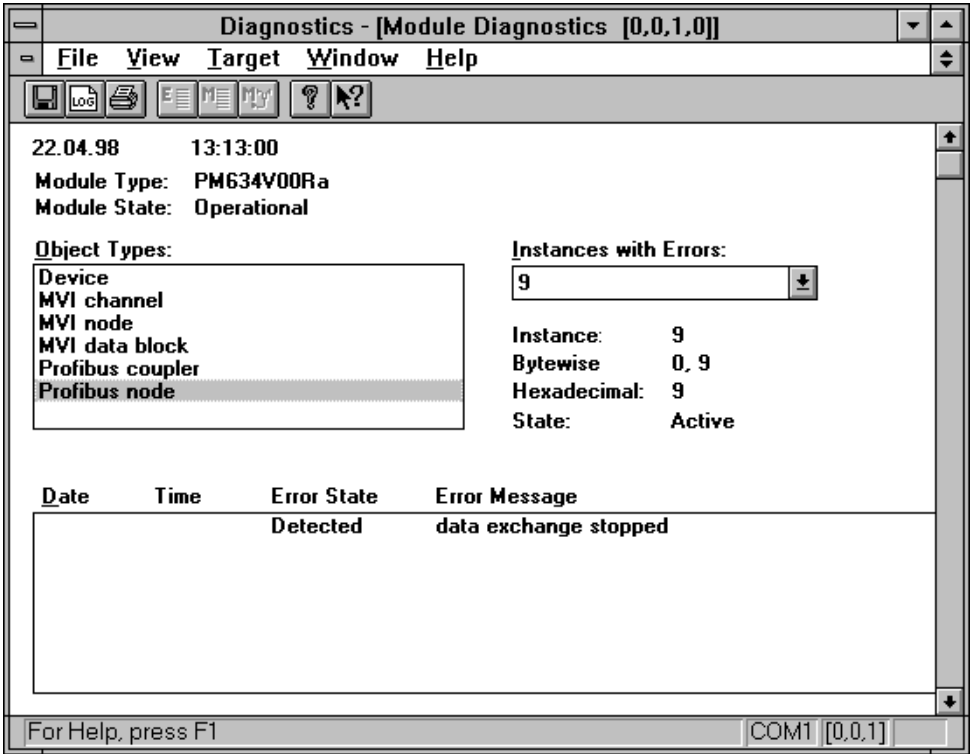


Figure 5-2. Example of Errors in Module Diagnostics Window

The relevant entries for the PROFIBUS interface are marked with **Profibus coupler** (for the PROFIBUS master) and **Profibus node** (for the PROFIBUS slaves).

Please note that the instance number given by the diagnostics tool (9 in the example) is equal to the PROFIBUS address of the related slave + 1.

5.4 Fault Finding and User Repair

If you follow the instructions in [Chapter 2, Installation](#) and in [Section 3.6, Application Procedures](#) and still do not have a correctly working communication link, please check the following:

1. Is the cabling correctly set up?

- The Processor Module interface must be properly connected to the PROFIBUS.
- The termination resistors must be properly in place.
- Check whether the PROFIBUS connectors are correctly wired.

2. Is the PB Data Base element correctly filled out?

- All network numbers in the Advant Controller node must be unique.

3. Are the PBS Data Base elements correctly filled out?

The device characteristics must match the vendor's device description.

The WDFACT terminals must be set to a value greater than zero. Otherwise the slave will not report any bus faults.

4. Check the Database and PC program application.

- Is the PROFIBUS-DP interface submodule correctly working?

The green LED must be lit.

- Is the bus coupler correctly configured?

The green LED must be lit.

- Are the PROFIBUS I/O devices correctly set up?

The indicators of the PROFIBUS I/O devices must show "operating mode".

5. Are there any Configuration Errors reported on AS 100ES?

Error messages may occur during download of the application, indicating that the configuration of the modules was not possible.

Check the error messages by executing the REPORT ERROR command within the FCB.

6. Are there any Status Bits set in the PB Data Base element?

7. Are there any Status Bits set in the PBS Data Base elements?

Check both, the standard PROFIBUS-DP diagnostic information and the device-specific diagnostic information. See chapter 3.7.3 on how to access this information.

If you know the answers to the following questions, further analysis will be easier:

- a. Are modems and cables installed as described in the *ABB Master Installation Rules* manual? Pay particular attention to the power supply and connection to signal ground.
- b. How is your control system configured? A block diagram with all node and network numbers is useful. Note also the type of PROFIBUS-DP I/O devices you are using.
- c. Have you made any significant changes in your configuration?
- d. Is it possible to repeat your problem case?
- e. Have you found any way to circumvent the problem?
- f. Have you made any other observations related to the problem?

A bus analyzer for monitoring the PROFIBUS line is also useful for further analysis. This test tool shows the traffic on the PROFIBUS and can be used to detect and trace down problems.

Appendix A Processor Module PM634

A.1 Summary

The Processor Module PM634 with PROFIBUS-DP interface is the module on which the CPU (central processing unit) of the Advant Controller 110 is located. It features a built-in PROFIBUS-DP interface that conforms to EN 50 170. The system software is stored in Flash-EPROM on the Processor Module.

A.2 Technical Data

Table A-1. PM634 with PROFIBUS-DP Interface, Technical Data

Component/Feature	Description/Value
Processor	Motorola MC68340, 25 MHz
Memory	1 MByte static System-RAM with battery back-up 1 MByte system software Flash-EPROM 1 MByte User Flash-EPROM
Realtime clock	Built in for time and calendar functions
Interfaces	2× RS 232C opto-isolated serial interfaces 1× RS 485 PROFIBUS-DP interface
Interface connector 1	CH 1: female 9-pin D-sub connector Pin 2 – TxD Pin 3 – RxD Pin 5 – GND Transmission line isolated via opto couplers, common 5 V, galvanically isolated against the Processor Module supply.
Interface connector 2	CH 2: male 9-pin D-sub connector Pin 1 – DCD Pin 2 – RxD Pin 3 – TxD Pin 4 – DTR Pin 5 – GND Pin 6 – DSR Pin 7 – RTS Pin 8 – CTS Pin 9 – RI Transmission line isolated via opto couplers, common 5 V, galvanically isolated against the Processor Module supply.

Table A-1. PM634 with PROFIBUS-DP Interface, Technical Data

Component/Feature	Description/Value
Interface connector 3	CH3a: female 9-pin D-sub connector Pin 1 – not used Pin 2 – n.c. Pin 3 – RxD / TxD-P Pin 4 – CNTR-P Pin 5 – DGND Pin 6 – VP Pin 7 – n.c. Pin 8 – RxD / TxD-N Pin 9 – CNTR-N Connector for the PROFIBUS-DP line
Interface connector 4	CH3b: female 9-pin D-sub connector Pin 1 – not used Pin 2 – n.c. Pin 3 – RxD / TxD-P Pin 4 – CNTR-P Pin 5 – DGND Pin 6 – VP Pin 7 – n.c. Pin 8 – RxD / TxD-N Pin 9 – CNTR-N Connector for the PROFIBUS-DP line (currently not used)
Power dissipation	< 20 W
Relay contact Max. voltage Max. current Max. DC switching power	48 V d.c. 0.5 A 10 W
Relay connector	3-pin connector Pin 1 – Normally closed when CPU in op. mode Pin 2 – Normally open when CPU in op. mode Pin 3 – Common signal
Sync input	24 V/10 mA, isolated Pin 1 – Synchronization input Pin 2 – Signal ground
Back-up	Backup of SRAM and Real Time Clock. Backup time 20 weeks.

A.3 Front Panel

All the following elements are located on the front of the module:

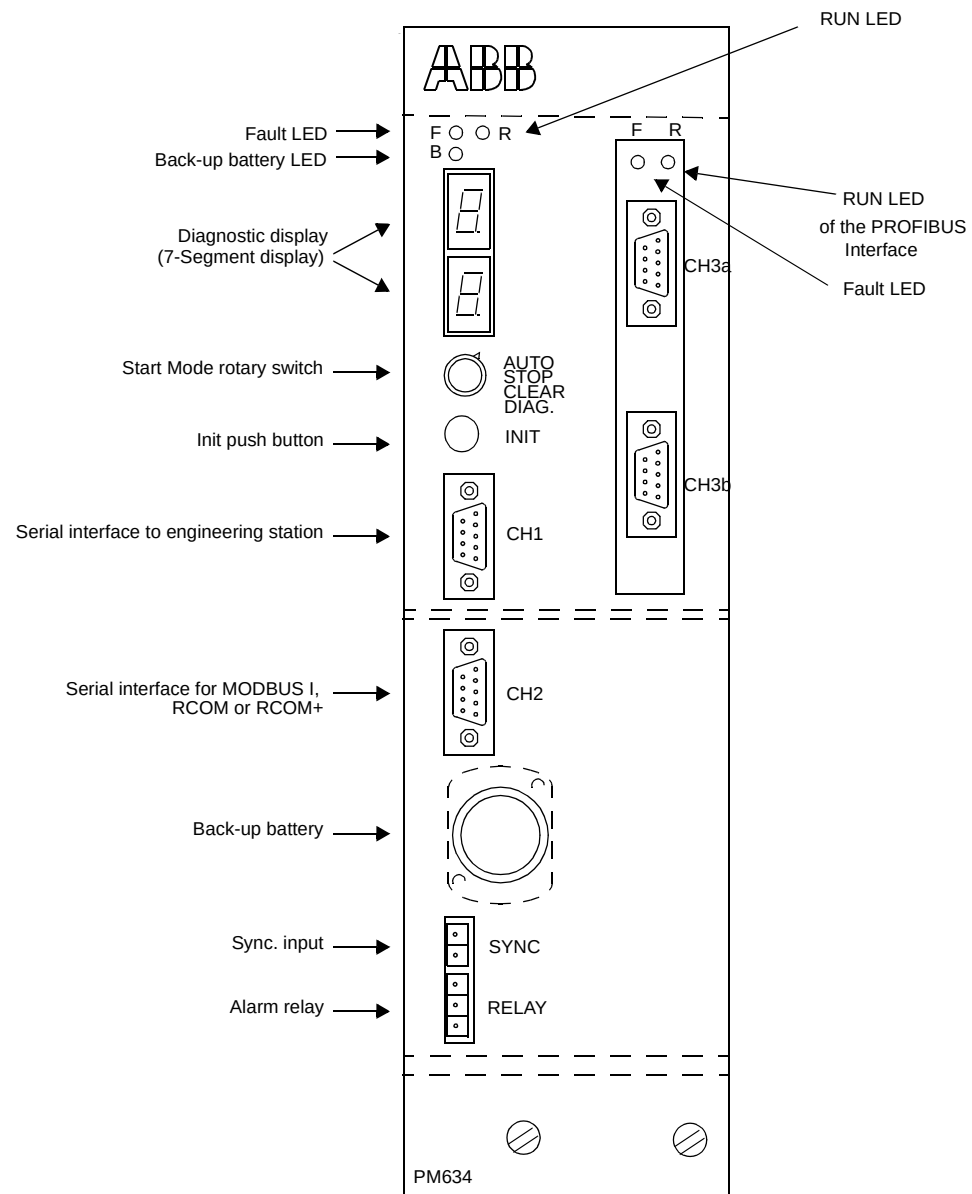


Figure A-1. PM634 with PROFIBUS-DP Interface, Front View

A.3.1 Indicators

Five LEDs and a diagnostic display indicate the status of the module.

A.3.1.1 System CPU Status LEDs

R(un) LED

The Run LED is green and indicates that the CPU is up and running.

F(ault) LED

The Fault LED is red and indicates a fault condition on the Processor Module.

B(attery) LED

The Bat LED is green and indicates that the battery backup voltage is ok.
This function is always enabled, independent of the setting of the attribute WITH_BAT of the DB element for PM634, which only enables or disables error report entries for battery supervision.

A.3.1.2 PROFIBUS Interface Status LEDs

R(un) LED

The Run LED is green and indicates that the PROFIBUS interface is up and running.

F(ault) LED

The Fault LED is red and indicates that either the initialization is running or a fault condition exists on the PROFIBUS interface.

A.3.1.3 Diagnostic Display

The diagnostic display indicates the Processor Module operating mode:

P-	= start-up
P1	= normal operation
P3	= stop after initialization
P4	= CPU is not running an application
P5	= loading application program from PROM
P6	= Engineering Station is connected and is in the on-line mode
PL	= waiting for download of system software
PU	= loading system software option (enabling options)
xx	= error code

If a two-digit hexadecimal number (xx) is visible, the system has stopped and the number represents an error code.

A.3.2 Buttons and Switches

A.3.2.1 INIT Push Button

Pressing the **INIT** push button initiates a CPU cold start.

A.3.2.2 START MODE Selector

The **START MODE** selector has three positions which influence the power-up and restart behavior of the CPU. If possible, a restart is made automatically after an error is detected.

CLEAR – cold start

The initialization procedure starts from the beginning and hardware and software are reset to their initial states. Application software is loaded from the internal PROM into the RAM. The cold start procedure is executed after power-up and after pressing the INIT push button.

The PROFIBUS interface is initialized, too.

AUTO – warm start

The system software attempts to restart the application program after an error occurs, and in doing so, checks the integrity of the application program loaded. If a restart is possible, the system software continues executing the application program. If the application program is corrupted, a cold start is executed.

STOP

The user can prevent the application program from starting if the start mode selector is in the stop position. The system software continues execution to allow access to the stored error messages using the ACC.

DIAG

The PM634 with PROFIBUS-DP interface has an additional switch position.

When started with the switch in position DIAG, it only performs the initial processor diagnostics. The results are shown on the Processor Module diagnostic display.

To restart the Processor Module again, put the switch in one of the other positions and press INIT.

Appendix B Processor Module PM644

B.1 Summary

Application

PM644 is a powerful non redundant Processor Module with PROFIBUS-DP master interface for Advant Controller 160. The Processor Module is based on 32-bit Motorola MC68360 processors and can be used to control and supervise processes and equipment in industrial and power plant environments.

PM644 can be placed in the positions 3–8 of the basic station. In multiprocessing applications up to 6 Processor Modules of type PM640, PM644, PM645, or PM646 can be used in one basic station. They communicate via the global memory (GMM) of an Advant Fieldbus 100 Communication Interface (CI626, CI627, CI630, or CI631). So for operation at least one of the Communication Interfaces has to be placed in position 2 (the redundant CI630, CI631 in position 1) of the basic station.

Module replacement

PM644 can be replaced under voltage, but process control is interrupted. After replacement the Processor Module and its assigned I/O channels must be restarted.

Functional description

The Processor Module PM644 is based on 32-bit Motorola MC68360 processors.

The application program and the PROFIBUS communication are processed with separate microprocessors and memories. Diagnostic information and a life sign are exchanged between both microprocessors.

The system software includes diagnostic routines which check the Processor Module PM644 and all used I/O and interface modules during initialization and ensure system integrity during the execution of the application program. Dedicated reactions can be defined within the application program. The system software also monitors whether the Processor Module has sufficient capacity to perform its functions within the times specified. If it does not, the Processor Module inhibits the application. The system software detects when I/O modules are withdrawn. New modules added to the application via the DB elements are initialized automatically.

During power up, the functions of the Processor Module and the contents of application and system PROM are checked as well as the internal RAM of the Processor Module PM644. While the application program is running, the diagnostic routines continue checking operation without impact on the execution of the application.

Memory

The Processor Module is supplied with a built-in memory. Additionally one module CI630 (or CI626) is necessary in the same controller and used as global memory for communication between the Processor Modules.

The application program is stored in a 1 MByte Flash PROM. The application runs from an SRAM copy of the Flash PROM.

On the Processor Module's processing section (PS), 2 MBytes of SRAM are available.

The SRAM copy of the program permits easy and quick modification and debugging of an application. After modification of an application, you can copy the new version back to the Flash PROM (back up).

For the specific task data exchange via PROFIBUS, the Processor Module additionally contains the communication section (CS) with its own microprocessor and memory. On the communication section 2 MByte Flash PROM for the system software and 2.25 MByte SRAM are available.

The BASE system software and the system software options are loaded via **Com A** front connector of the Processor Module to Flash PROM. It is not necessary to replace the Flash PROM or to open the metal case of the Processor Module. A change of the system software can be performed directly when the module is power-on state.

Backplane

PM644 is to be connected to the multi master backplane. The respective basic subrack RF616 is to be used.

B.2 Technical Data

Table B-1. PM644 Technical Data

Features	Data
Processor for application program	Motorola MC68360 Microprocessor, 33 MHz ⁽¹⁾
Memory for application program	2 MByte Flash PROM system software 1 MByte Flash PROM application program and boot sector 2 MByte SRAM for application purposes
Processor for PROFIBUS communication	Motorola MC68360 Microprocessor, 33 MHz
Memory for PROFIBUS communication	2 MByte Flash PROM system software 2.25 MByte SRAM
Real Time Clock (RTC)	Built in for time and calendar functions
Watchdog	1 software watchdog activated after 10 ms 1 external hardware watchdog activated after 150 ms
Count interface	RS 422 interface, 15-pin Sub-D, female
Interfaces Com A and Com B	2× RS 232C opto-isolated serial interfaces, V24
Interface connector Com A and Com B	9-pin Sub-D, female (per interface). Section 1: Pin 2 – TxD Pin 3 – RxD Pin 5 – GND
Relay connector	3-pin connector Pin 2 – Common Pin 1 – Normally closed when Processor Module in operational mode Pin 3 – Normally open when Processor Module in operational mode
Relay plug with cable	3BHT 310359R1 3 × 1 mm ² , 3 m length
Relay contact	
Max. voltage	48 V DC
Max. current	0.5 A
Max. DC switching power	10 W
Interface Ch1a	RS 485 galvanically separated serial PROFIBUS interface

Table B-1. PM644 Technical Data (Continued)

Features	Data
Interface connector Ch1a	9-pin Sub-D, female Pin 1 ⁽²⁾ – Shield, Protective Ground Pin 2 ⁽²⁾ – Minus 24V Output Voltage Pin 3 RxD/TxD-P Receive/Transmit-Data-P Pin 4 CNTR-P Control-P Pin 5 DGND Data Ground Pin 6 VP Voltage-Plus Pin 7 ⁽²⁾ – Plus 24 V Output Voltage Pin 8 RxD/TxD-N Receive/Transmit-Data-N Pin 9 CNTR-N Control-N
Power dissipation	< 12 W

(1) Processor Modules without BSE article number are equipped with 25 MHz clock with therefore decreased performance

(2) Not used

B.3 Front Panel

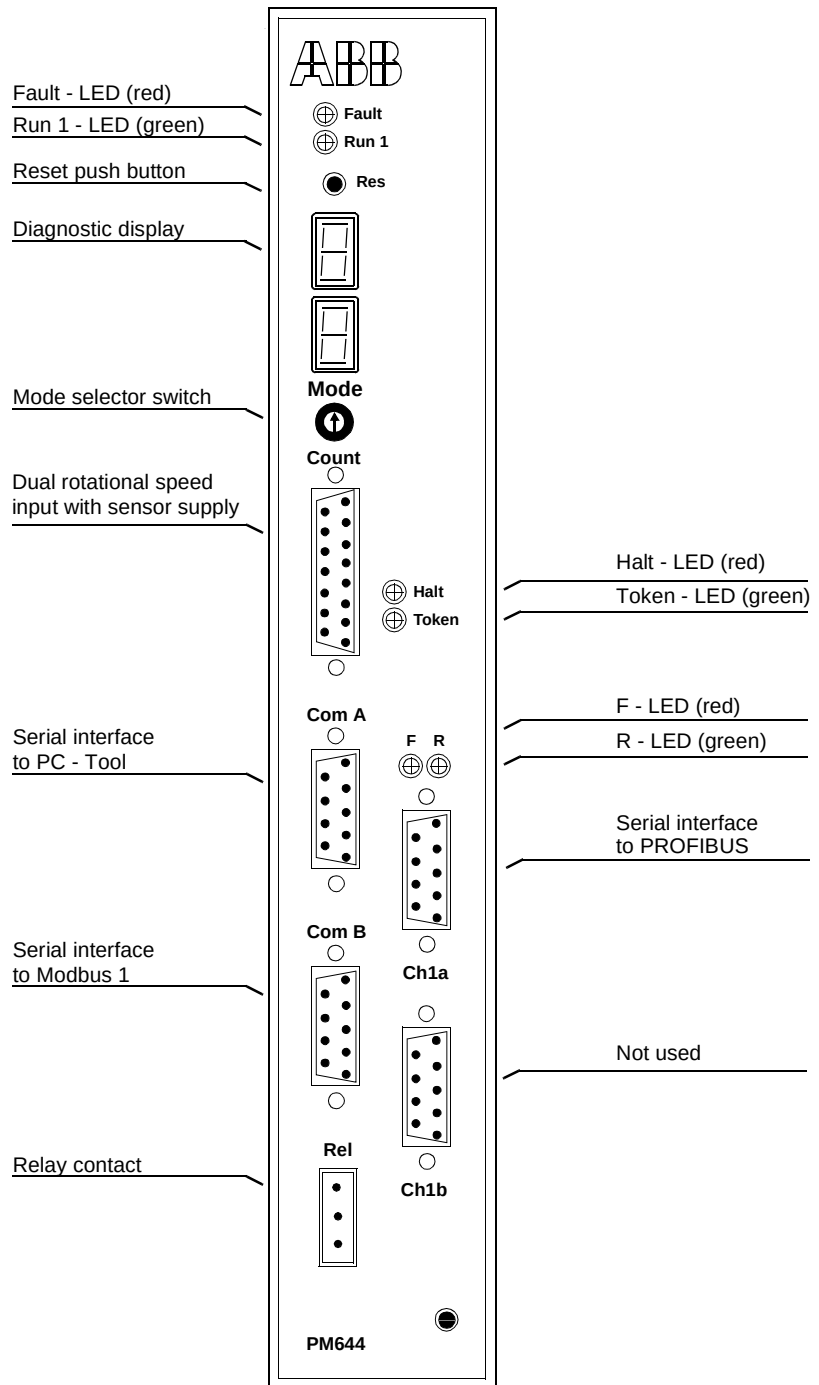


Figure B-1. Processor Module PM644, Front View

B.3.1 Indicators

Six LEDs and a diagnostic display indicate the status of the module.

B.3.1.1 LED-Status Indication

Run1 LED

The Run1 LED is green and indicates that the application program is executing normally.

Fault LED

The Fault LED is red and indicates a fault condition on the processor module.

Halt LED

The Halt LED is red and indicates a halt condition on the PROFIBUS interface processor.

Token LED

The Token LED is green and indicates the PROFBUS token.

R(un) LED

The Run LED is green and indicates that the PROFIBUS interface is configured and operational.

F(ault) LED

The Fault LED is red and indicates that the initialization is running or an error occurred on the PROFIBUS interface.

B.3.1.2 Diagnostic Display

The diagnostic display consists of an upper part and a lower part and indicates:

- Error codes in case of a system stop of the Processor Module.
The LED Run 1 does not light and "P" is not shown on the diagnostic display.
- Processor Module functions in the system.
The character "P" is always shown in the upper part. A digit or a character which indicates the control mode in accordance with the examples below is shown in the lower part

The diagnostic display indicates the Processor Module's operating mode as follows:

P-	= start-up
P1	= normal operation
P3	= stop after initialization
P4	= CPU is not running an application program

P5	= loading application program from PROM
P6	= Engineering Station is connected and is in online mode
PL	= waiting for download of system software
PU	= loading system software option
xx	= error code

If a two-digit number (xx) is visible, the system has stopped and the number represents an error code.

B.3.2 Buttons and Switches

B.3.2.1 Res Push Button

Pressing the **Res** push button initiates a cold start of the Processor Module.

B.3.2.2 Mode Selector

The **Mode** selector has four positions but only position 0 and 1 are used. The **Mode** selector defines the power up and restart behavior of the Processor Module. If possible, a restart is made automatically after severe error is detected.

Mode 0 – Stop

The user can prevent the application program from starting if the mode selector is in position 0. The system software continues execution to allow access to the stored error messages using the Advant Station 100ES.

Mode 1 – Cold start

The initialization procedure starts from the beginning and hardware and software are reset to their initial states. Application software is loaded from the internal PROM into the RAM. The cold start procedure is executed after power up and after pressing the Res push button.

B.3.3 Front Connectors

B.3.3.1 Serial Interfaces

There are three serial interfaces on the Processor Module:

- Front connector **Com A** to connect the Advant Station 100ES programming tool. Communication speed is fixed at 9600 bit/sec.
- Front connector **Com B** for exchanging data using the optional Modbus protocol with an operator station based on a personal computer. Communication speed is fixed at 9600 bit/sec. No parity; 1 Stop Bit, 1 Start Bit.
- Front Connector **Ch1a** to PROFIBUS, see below.

B.3.3.2 Relay Contact (Floating)

The contact can be wired in closed-circuit principle (use Pin 1 and Pin 2) or in open-circuit principle (use Pin 3 and Pin 2).

During normal operation with closed-circuit principle the contact is closed. In case of severe errors or during reboot the contact is open.

During normal operation with open-circuit principle the contact is open. In case of severe errors or during reboot the contact is closed.

B.3.3.3 PROFIBUS Connection

With the front connector **Ch1a** the PROFIBUS can be connected to the PM644. The PROFIBUS interface (according to EN 50170) supports the following features:

- Galvanically separated RS 485 interface (without bus termination)
- Transmission speeds from 9600 Baud up to 12 MBaud
- PROFIBUS-DP master (class 1)
- using of up to 125 PROFIBUS-DP slaves

B.3.3.4 Rotational Speed Connection

With the front connector **Count** two incremental inputs with speed measurement and recognition of the direction of the rotation (for example for turbine/drive speed) are available. Each channel includes two RS422 tracks (A and B) for connection of a pulse sensor. The direction of the speed measurement is identified through the phase displacement. Synchronization is not supported.

If the input for recognition of the direction of the speed measurement is not used (B not wired), the PM644 assumes positive direction.

To supply the external sensors two short-circuit-proof 24 V output voltages are available. The outputs are short-circuit and break monitored. The rated current amounts to min. 10 mA and max. 100 mA.

The accuracy of the speed measurement depends on the cycle time of the control task within the application program, which contains the PC element RSM. The length of the cycle time is directly proportional to the measuring accuracy.

Input frequency: max. 40 KHz.

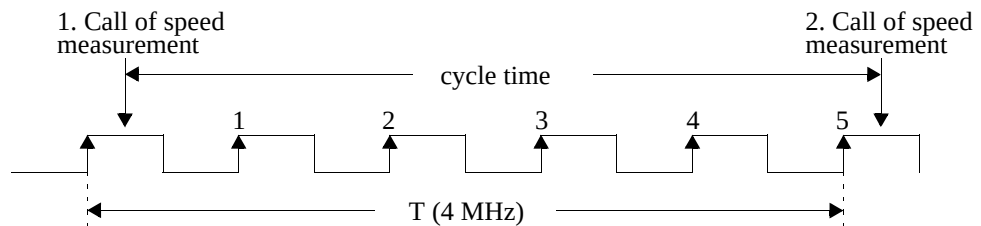


Figure B-2. Speed Input Pulses versus Time

Only the rising pulses are counted. The speed is calculated via the amount of pulses received within one cycle. Time "T" is measured with 4 MHz, measured from the last pulse in the last cycle until the last pulse in the actual cycle. This is done by the hardware.

If a very slow speed should be measured, the cyclic time in the control module must be less than 4,19 sec. A very slow speed is a speed where not in each cycle a pulse occurs for example with emergency turning gear.

Each incremental sensor channel (1 and 2) including sensor supply reserves 7 contacts of the 15-pin Sub-D-plug on the front of the PM644.

Connector allocation:

Table B-2. Connector Allocation of Rotational Speed Inputs

PIN	Explanation
1	24 V supply voltage 1+
2	supply voltage 1-
3	incremental sensor input A1+
4	incremental sensor input A1-
5	incremental sensor input B1+
6	incremental sensor input B1-
7	shield
8	not connected
9	24 V supply voltage 2+
10	supply voltage 2-
11	incremental sensor input A2+
12	incremental sensor input A2-
13	incremental sensor input B2+
14	incremental sensor input B2-
15	shield

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